WHY MUCH DEPENDS ON NPD-2 6

PROPOSALS FOR CHANGE IN ANTI-COMBINES LAWS . . . 71

EN-73 1062
MEDFORTH G T 13
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4

NOVEMBER, 1961

ELECTRICAL NEWS & ENGINEERING

A SOUTHAM-MACLEAN PUBLICATION

WITH NEW FULLY INSULATED "PELICAN" FIBERGLASS AERIAL BUCKET

Now crewmen can work aloft in complete safety . . . thanks to this lightweight Pitman "Pelican". Aerial bucket and telescopic section are made of molded fiberglass for insulation in excess of 140,000 volts. The new "Pelican" is Canada's first truly insulated aerial unit.

Automatic levelling hydraulic cylinder keeps bucket level at all times . . . air actuated controls through nylon tubing let operator swing bucket 360° in either direction and elevate from ground level to 75° above horizontal.

The new "Pelican", with over 300 lbs. capacity, is ideal for work on electrical distribution lines, street light maintenance, tree trimming . . . any high job. Available in 28′, 32′ and 36′ models . . . can be mounted on any 1 to 2 ton truck.

If it's new . . . if you want unequalled quality and value . . . look to Smith Bros. Leading the industry since 1843. Offices in Toronto, Montreal and Calgary.

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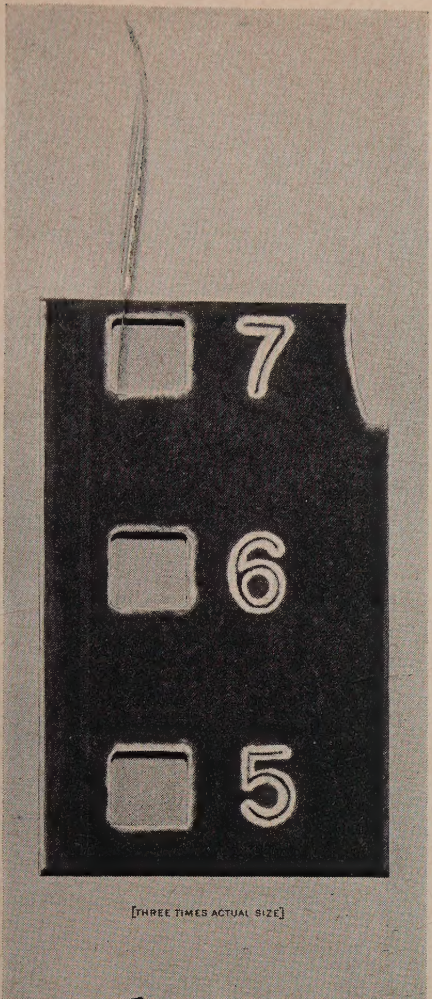

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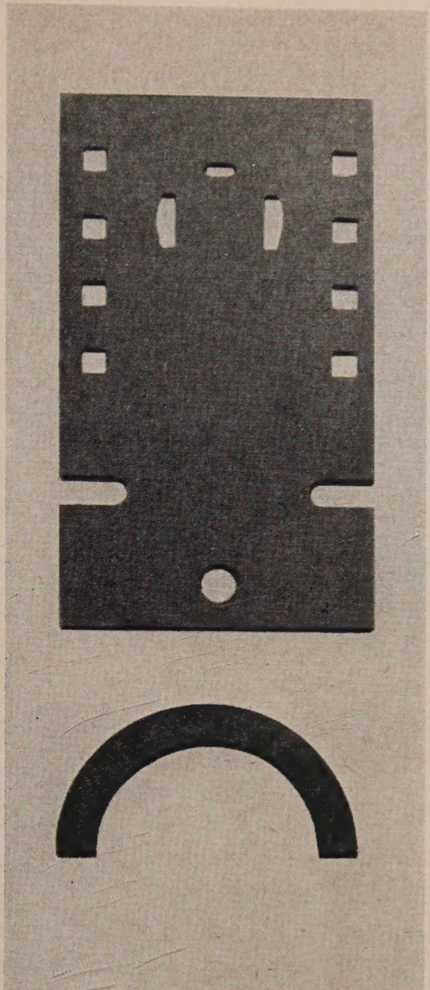

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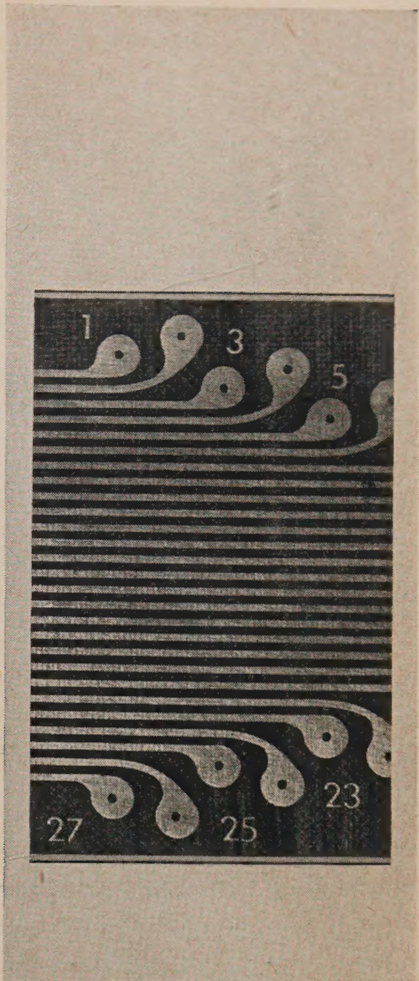

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three outstanding new laminates!

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Economical paper phenolic grade 2450P can be punched warm and has improved mechanical strength and lower moisture absorption properties. It is designed especially for mechanical and low voltage electrical insulation applications such as connector blocks, coil and bobbin ends, washers, plug and socket bases. Meets NEMA X and XP requirements.

Excellent wet electrical and other improved properties make this new copper-clad glass fabric Teflon* laminate ideal for radar insulation, missile antennas, critical computer applications. Circuits based on this grade will show minimum drift under varying temperature and humidity. Also available without copper for such uses as high frequency insulation in wave guides.

These are the newest materials of CDF research and engineering, developed to give you outstanding performance at minimum cost. Your inquiry is welcomed.

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WITH THE EDITOR

Canada's pride and joy?

The anxious hopes of many people are centred on a small experimental power station in Ontario. The 20-megawatt Nuclear Power Demonstration (NPD-2) plant is soon to go critical.

As an Ontario Hydro executive explains on another page, some 7,000 Mw of nuclear capacity could be installed in his province alone by 1980. 'Could' can become 'will' if NPD-2, and its bigger successor at Douglas Point, prove both reliable and cheap.

The success of Canadian-developed nuclear power is interesting, if less urgently so, to other provinces too.

But it is our nuclear plant manufacturers and fuel processors, and Canadian prestige abroad, that stand to gain the most. Already India has shown interest in the natural uranium, heavy-water-moderated reactor (ENE, August 1961, p. 26).

In the eyes of potential buyers in the underdeveloped lands, the main competitive types of nuclear plants could have serious drawbacks. Britain's graphite-moderated stations do not provide cheap energy. The advanced gas-cooled reactor may do so, but commercial operation is not expected before 1970. Purchasers of American light-water reactors would be at the mercy of a single country for their fuel supply of enriched uranium. Moreover, the U.S. government is believed to be considering the removal of subsidies and controls on this fuel. American owners of nuclear stations fear that a 'free' fuel will be a dear fuel.

Thus the CANDU type — and later, perhaps, a fog-cooled modification — may gain worldwide acclaim. But there's many a slip . . . ., which is why we wait for NPD-2 results with best wishes and crossed fingers.

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ELECTRICAL NEWS
& ENGINEERING

VOL. 70 NO. 11 NOVEMBER 1961

Interpreting power technology and administration to engineers and management in the utility and electrical industry, *ELECTRICAL NEWS AND ENGINEERING* deals with the thermal and hydraulic generation of electricity, its transmission, distribution and use.

67 GS PLANNERS AWAIT OPERATION OF 200-MW NUCLEAR PLANT WITH BATED BREATH
7000 Mw of nuclear capacity could be added to Ontario system by 1980

69 AFTER CANDU — FOG-COOLED REACTORS?
Ordinary wet steam replaces heavy water as coolant in an unusual reactor proposal now being evaluated by AECL. Energy costs look promising

71 OUR ANTI-COMBINES LAWS WORK BADLY DURING HARD TIMES, SAYS ECONOMIST
A call for recognition of the virtues of some implicit price agreements. A senior government official explains some of the administrator's problems

74 ANY SAVINGS FROM OUTDOOR PLANT?
The pace of thermal innovation remains high, but new problems keep cropping up

78 OTTER RAPIDS POWER IS FED INTO PROVINCIAL GRID
Another northern river is harnessed. Output, now 86 Mw, could eventually reach 340 Mw

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COVER ILLUSTRATION — The 20-Mw Nuclear Power Demonstration plant at Rolphton, Ontario. The future power development of at least one province depends on its operating costs — soon to be tested.

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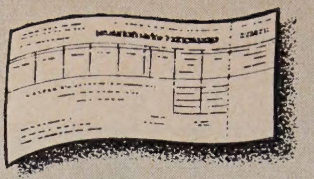
NEW SANGAMO TYPE H THERMAL CONVERTER HERMETICALLY SEALED EXTREMELY HIGH ACCURACY UNDER ALL OPERATING CONDITIONS



Billing accuracy within extremely close limits is now possible. The most remarkable characteristic of this new precision instrument is, however, its amazing stability.

- All organic material eliminated from inside the hermetically sealed, drawn copper capsule—no ageing. No effect from humidity, barometric pressure, dust, dirt or gas.
- There are no moving parts . . . no wear, no maintenance.
- High accuracy—close adherence to logarithmic response. Error does not exceed 0.25 of 1% full load output with ambient *temperature* variations from −15° C to +55° C or *voltage* variations + or −20% of rated voltage or *current* variations from zero to full current input.
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CONVERTER**

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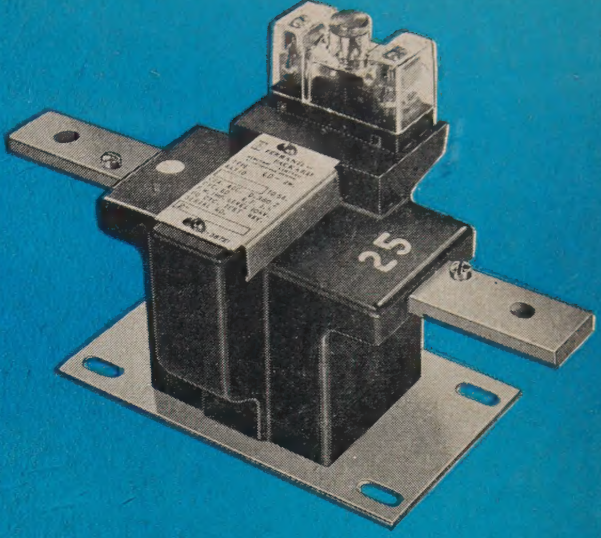
FERRANTI-PACKARD

600 VOLT METERING TRANSFORMERS

Accuracy and dependability are inherent in the Ferranti-Packard line of 600 volt potential and current transformers. They are designed with particular attention to installation requirements.



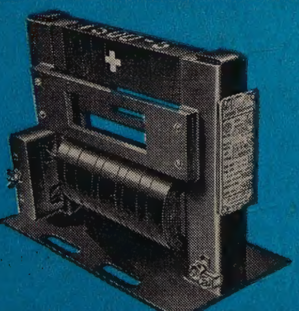
The new epoxy moulded, 2 and 3 wire Type LD current transformers have a metering accuracy of 0.3 and a continuous current rating of 150%.

The LD . . .

. . . Is safe to install. The secondary terminal block is positioned to reduce the hazard of physical contact with the primary bars when wiring-up.

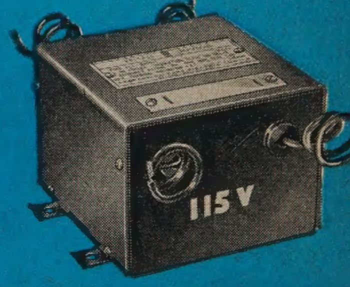
. . . Is completely interchangeable with previous 600 volt designs.

. . . Nameplate is located on top of the core for easy reading. This position provides maximum creepage distances.



The Ferranti-Packard "Through" Type T current transformer is available from 1000 to 4000 amperes. Designed for bus bar applications, this unit is compact and light in weight.

The Ferranti-Packard epoxy moulded "Through" Type RL current transformer has a metering accuracy of 0.6B0.2 through the complete range of 100 to 400 amperes.



The Ferranti-Packard "Dry" Type VLI voltage transformer provides a neat, compact and easily mounted unit. It is designed as a companion to the 600 volt Current Transformers.

Ask your Ferranti-Packard Representative for details.

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Corrosion Resistance—No special preparation needed (other than normal galvanizing) for use in industrial, sea coast, or contaminated areas.

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- **BASIC IMPULSE LEVEL OF 15 KV WITH 5 KV SPARK-GAP** — co-ordinated insulation for surge protection.
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- **IMPACT PROTECTION** — eliminates handling problems.
- **CONTROLLED TEMPERATURE RISE** — precise fuse operation.
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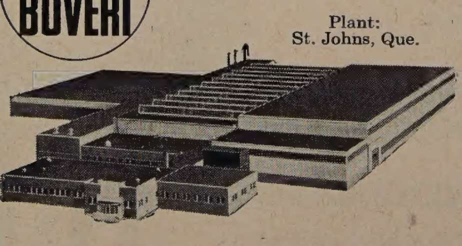
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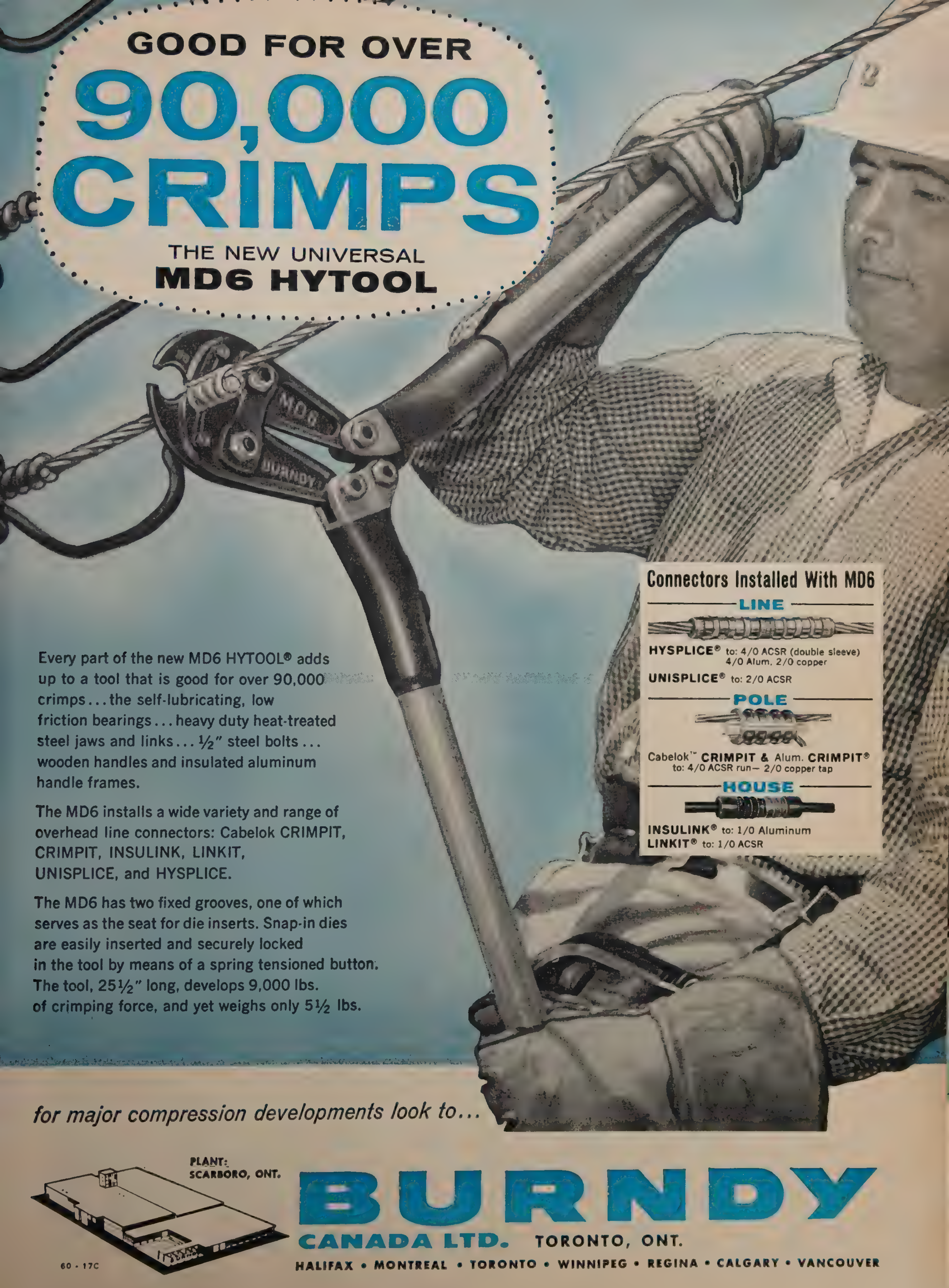

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The MD6 installs a wide variety and range of overhead line connectors: Cabelok CRIMPIT, CRIMPIT, INSULINK, LINKIT, UNISPLICE, and HYSPLICE.

The MD6 has two fixed grooves, one of which serves as the seat for die inserts. Snap-in dies are easily inserted and securely locked in the tool by means of a spring tensioned button. The tool, 25½" long, develops 9,000 lbs. of crimping force, and yet weighs only 5½ lbs.

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to: 4/0 ACSR run— 2/0 copper tap

HOUSE

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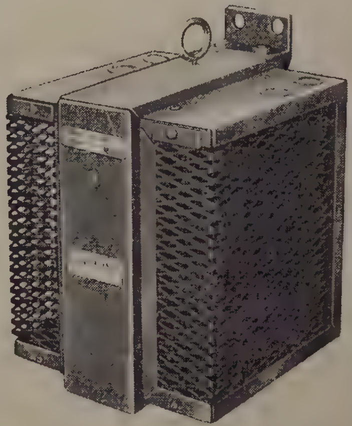
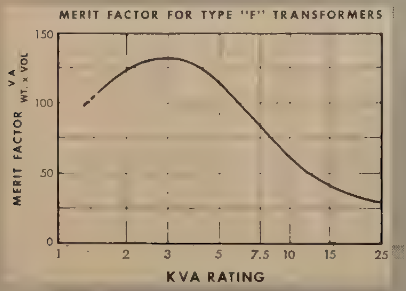
. . . solves problems of corrosion, dust and dampness. This new Hammond Transformer, vacuum filled with Epoxy-Silica will give dependable service in particularly difficult applications. It is designed to dissipate heat efficiently and to operate under conditions where corrosive agents, moisture and dust must be considered.

TYPE "F"

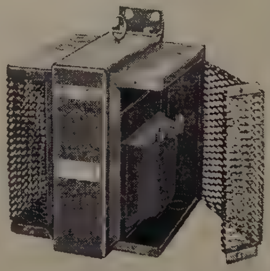
Lightweight "Air Cooled" TRANSFORMER



. . . now completely re-designed for size and weight reduction. The "F" Type has been a popular item in Hammond's line of Industrial Transformers and an accepted unit for the most economical layout of lighting and low voltage power circuits. The latest "F" Type offers increased reliability and overload capacity.



The merit factor, $\frac{V.A.}{Wt. \times Vol.}$ combines the factors V.A./lb. and V.A./cu. in. The larger the factor the greater the economy of weight and space achieved.



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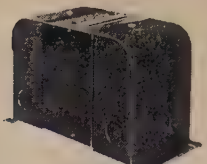

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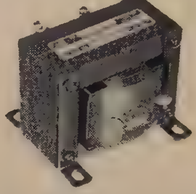
TYPE "E" has long been one of the most widely used industrial Transformers in Canada. The "E" line is now extended to include 8 new voltage combinations.



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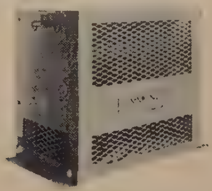

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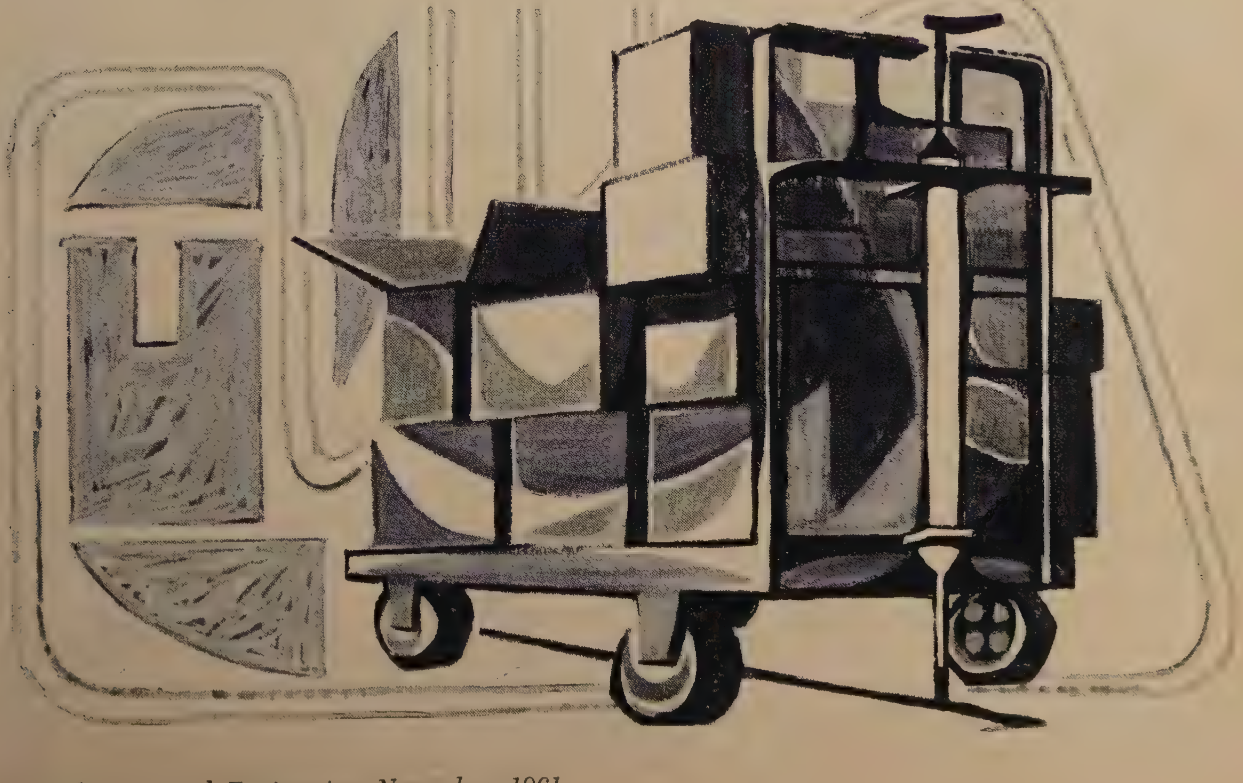

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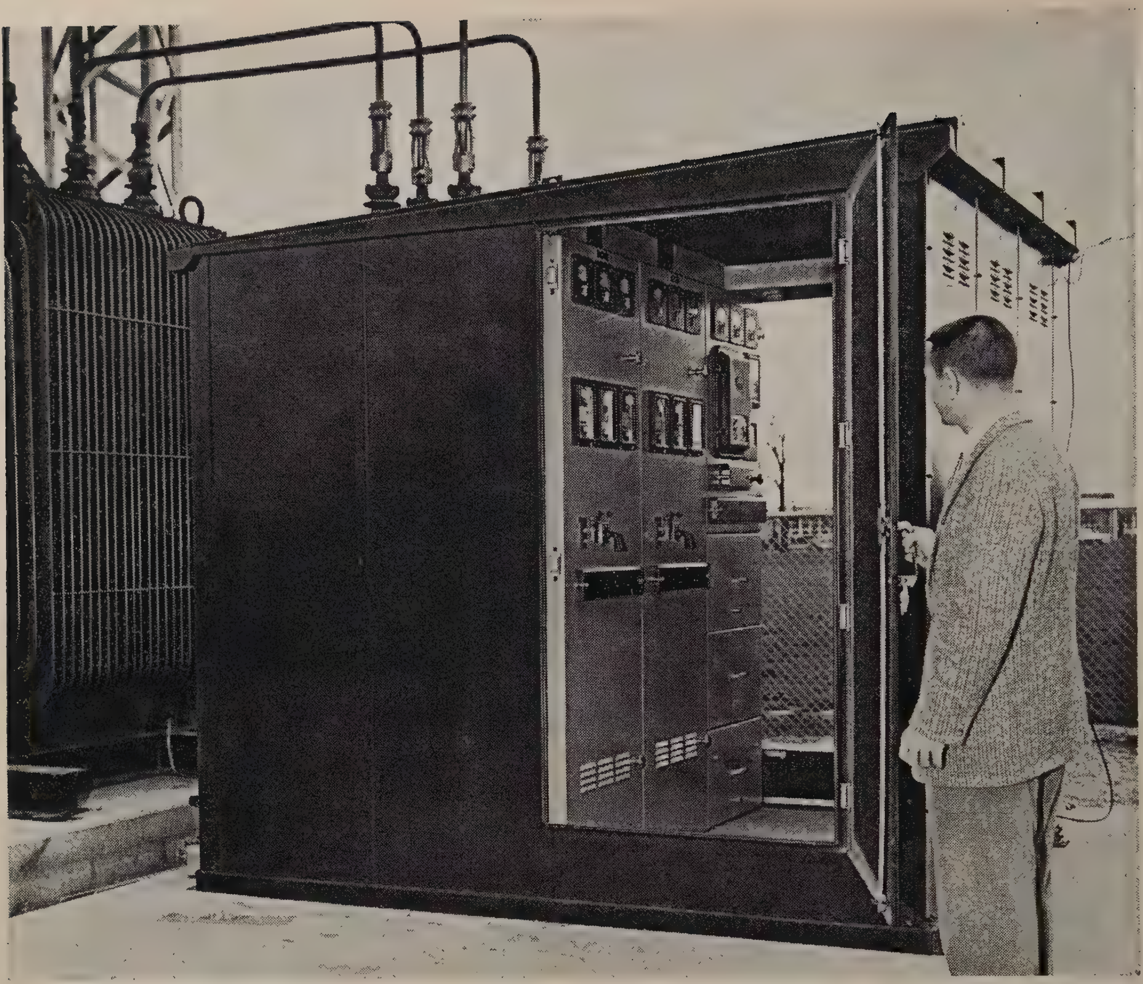

5 KV 150 MVA Type VL8 Outdoor Metalclad Switchboard supplied to Burlington P.U.C.

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English Electric 5 KV Class VL8 metalclad switchgear is highly standardized, easy to install and simple to operate. It meets C.S.A., C.E.M.A., and N.E.M.A. standards and is readily adapted to the special requirements of customers' installations. Designed specifically for utility and industrial use, it offers:

- Tested performance for interrupting capacity, temperature rise and basic impulse level.
- Insulated bus plus air clearances to C.S.A. C22.2 No. 31.
- Complete segregation with gas barriers between the main compartments for circuit breakers, busbars and potheads.
- Automatic shutters of grounded metal.
- Either indoor or outdoor designs. Outdoor design incorporates a wide aisle allowing breaker maintenance inside housing.
- Choice of manual, spring or electrical mechanism (AC or DC).

'ENGLISH ELECTRIC'
CANADA

SWITCHGEAR

B.120

ENGLISH ELECTRIC CANADA, a division of JOHN INGLIS CO. LIMITED

TORONTO · MONTREAL · QUEBEC · OTTAWA · HAMILTON · WINNIPEG · CALGARY · VANCOUVER AND HALIFAX

THE 3 ESSENTIAL INGREDIENTS BEHIND YOUR CABLE PRESCRIPTION

- **Accuracy in diagnosis** of your cable needs based on years of experience.
- **A specific formula** engineered to your individual requirements.
- **A painstaking compounding** of materials to produce a cable to these specifications.

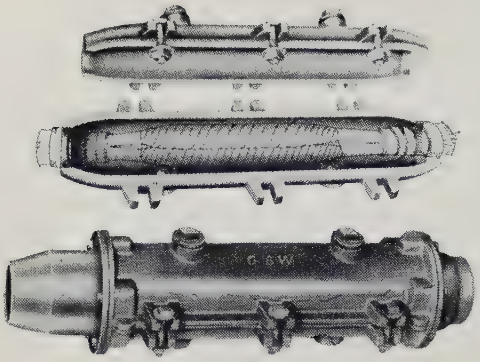
These are the reasons why important cable orders of recent years have been placed with Phillips.

Phillips Electrical Company Limited, Head Office—Brockville, Ontario. Branches—Halifax, Montreal, Ottawa, Toronto, Hamilton, Winnipeg, Edmonton, Vancouver. The Canadian affiliate of the BICC Group.

Phillips Electrical Company LIMITED

WIRES CABLES

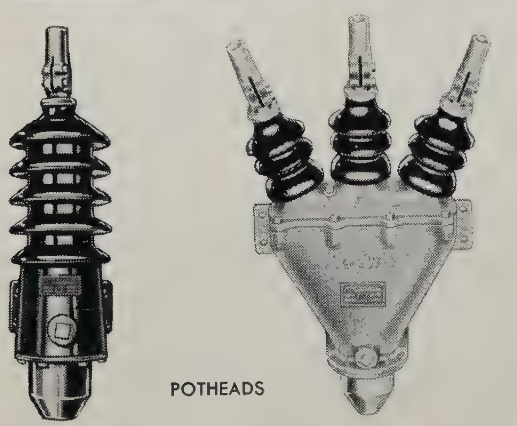
6033



CABLE SPLICE PROTECTION BOXES

CABLE SPLICING KITS

G&W the utility engineer's choice!



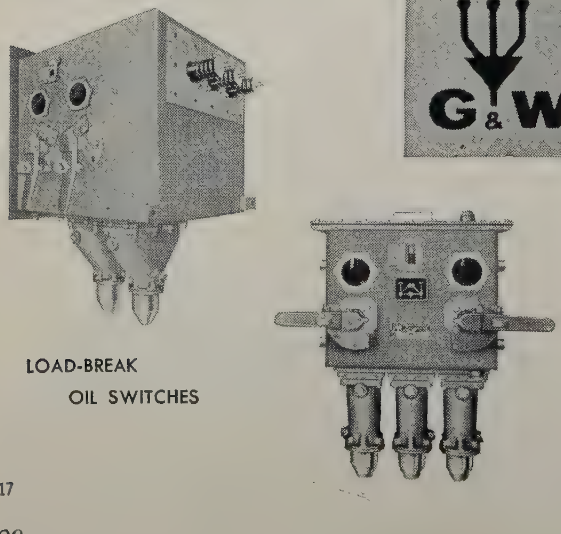
POTHEADS

Utility engineers know the need for reliable distribution and sectionalizing equipment—they cannot risk power failures because of faulty design or construction. That is why most Canadian utilities choose G&W equipment—proved in service to be reliable, installation after installation, year after year. All such equipment is made in Canada of Canadian materials by Powerlite. Ask any utility manager who has G&W equipment in service and he will vouch for G&W's quality and reliability.

Are you enjoying these benefits on your distribution system? If not, write for fully descriptive literature from our nearest office.

54 Atomic Ave., Toronto 18, Ont.
233 Dunbar Ave., Montreal 16, P.Q.
882 East Cordova St., Vancouver 4, B.C.

G&W



LOAD-BREAK
OIL SWITCHES

MADE IN CANADA BY

Powerlite devices limited

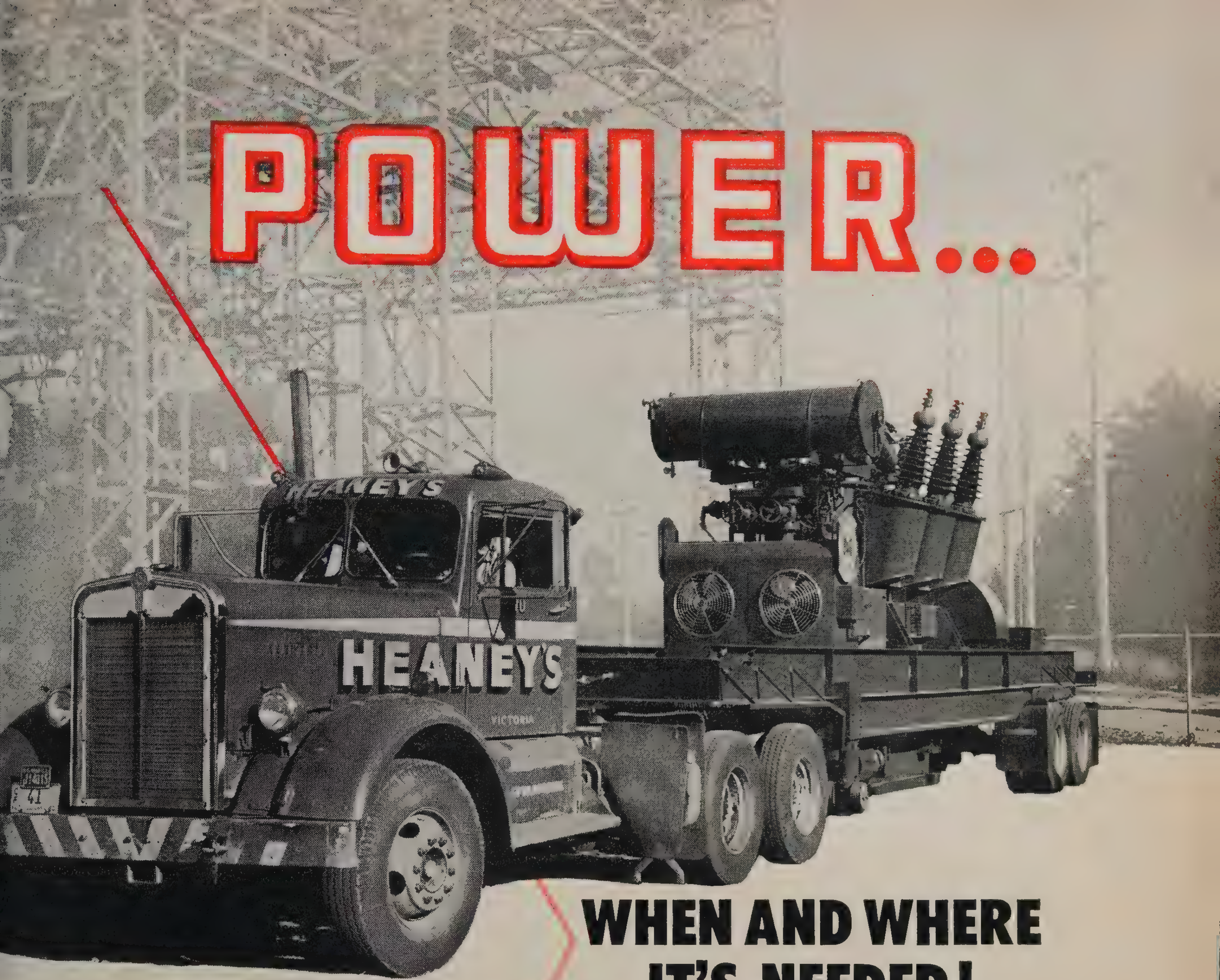
100% Canadian owned and operated

MONTREAL . TORONTO . VANCOUVER

DISTRIBUTORS FROM COAST TO COAST

6117

POWER...



WHEN AND WHERE IT'S NEEDED!

B.C. ELECTRIC'S NEW 15,000 KVA MOBILE SUB-STATION CUSTOM BUILT BY MOLONEY ELECTRIC

Rating 15,000 KVA. High Voltage 60,000 Volts △, Intermediate Voltage 12,480 Y/7200. Low Voltage 4,160Y/2,400.

Forced oil cooled, with primary fuses and disconnects, cables, trailer and accessories. Total weight 33 tons.

Complete unit designed and built in Canada. Write for additional information.

Specialists in Transformers

MOLONEY

ELECTRIC COMPANY OF CANADA LIMITED

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REGIONAL OFFICES: MONTREAL, CALGARY, VANCOUVER

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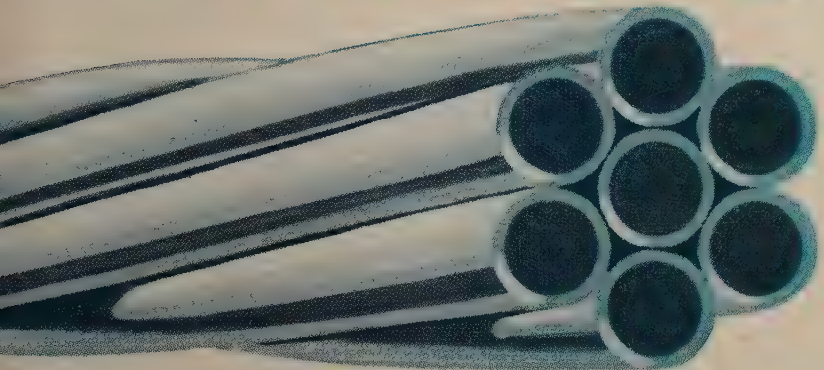
PERMANENT SUPPORT
for your poles and aerial cables
ALUMOWELD GUY AND MESSENGER STRAND
thick aluminum covering
strong steel core
controlled atomic weld

ALUMOWELD®

GUY AND MESSENGER
STRAND



combines the rugged strength of steel with the corrosion resistance of aluminum

Since Alumoweld will not rust or corrode, its high strength is permanent. Costly maintenance is eliminated because Alumoweld Guys and Messengers stay up for the life of the installations they support.

Alumoweld is the only strand made with wires having a *thick* aluminum covering — 25% by area. And the aluminum cannot crack, flake or peel . . . it is interlocked with the steel core by a ductile weld that is permanent under all operating conditions.

The rugged strength of Alumoweld is the same as steel, but Alumoweld will last far longer. In fact, Alumoweld has the same long life and corrosion resistance as solid aluminum.

Weighing 18% less than steel of comparable diameter, Alumoweld is easier to handle. Moreover, Alumoweld has a higher strength-to-weight ratio than any other strand used on overhead lines. For messengers, you can string safer, longer spans with less sag.

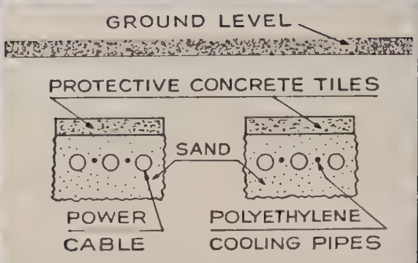
It's easy to see that Alumoweld offers economies you can't afford to pass up. Put this light-weight, high-strength strand on your lines and prove it for yourself.

Get all the facts on this strand from your nearest Northern Electric office.

A PRODUCT OF COPPERWELD STEEL COMPANY
DISTRIBUTED BY
Northern Electric
COMPANY LIMITED

3061-3

Buried Beside



Three polyethylene-jacketed high tension cables will be kept at safe low temperatures with the two thermostatically-controlled water pipes—as shown in this illustration.

Toronto's Fred Gardiner Expressway . .

Polyethylene water piping COOLS OFF 'hot' voltage!

PROBLEM: Buried high tension cables, working at peak loads, generate a lot of heat. The heat must be dissipated and, because the cable is buried, the solution to the problem must be both sure and permanent.

SOLUTION: Toronto's Fred Gardiner Expressway. Ontario Hydro specifications called for water cooling to meet future power needs and loads. Pirelli Cables met the need with UNION CARBIDE polyethylene.

The water cooling is not yet needed, but when the power load rises to its peak, polyethylene piping will be ready to dissipate the extra heat generated.

Polyethylene water piping, for cooling electrical cables, has been laid before . . . pioneered on this same expressway job in 1957. But on the 1960 installation even more extensive use was made . . . UNION CARBIDE polyethylene was used for both the water cooling pipes, and the oil-filled cable jacketing as well.

There's probably a way that polyethylene can help you do a job better—more economically—or both. Union Carbide can tell you about it. Contact them soon!

Write Union Carbide Canada Limited,
Chemicals and Plastics Division,
123 Eglinton Ave. E., Toronto 12.

"Union Carbide" is a trade mark.

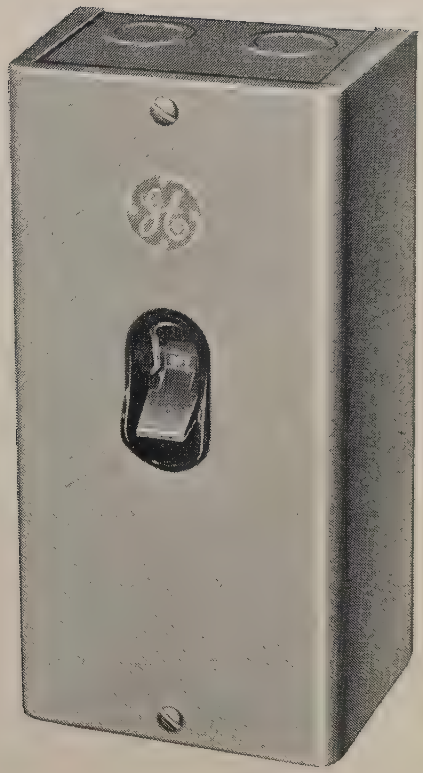
UNION CARBIDE POLYETHYLENE

IT'S NEW!

The Canadian General Electric

Motor Matched

CR1062 MANUAL MOTOR STARTER



100% Canadian—
Designed and Manufactured by CGE
Outstanding Quality and Reliability
Modern Compact Design
Ratings—7½ h.p., 220 Volts; 10 h.p., 550 Volts

This new CGE manual motor starter has many desirable features. Some of these are . . .

- **Rugged mechanism with positive snap action.**
- **180 degree accessibility for easy installation and wiring.**
- **3 overload relays as standard equipment.**

Call your local CGE Sales Office or Distributor for complete details.

AAD-9204-41801

CANADIAN GENERAL ELECTRIC

CONTACTOR IN PLACE

SPEEDS INSPECTION AND MAINTENANCE OF LIMITAMP CONTROL

Maintenance is an easy job with Canadian General Electric's new draw-out Limitamp control. Routine maintenance is quickly performed with the contactor in place. Coils and contact tips can be changed in a matter of minutes. Simply lift out the arc chutes and one arc horn to expose the bolts holding coils and tips in place.

To make your job still easier, a magnet-head wrench is supplied with each unit. This wrench fits all bolts necessary to change coils and tips. And, remember . . . Limitamp control is all front connected.

To replace fuses, you just pull the ejector and the fuses pop up. When a fuse is replaced, it is guided into position by a back-stop on the clip.

For complete information on the all-new Limitamp Motor Control, contact your nearest C-G-E Sales Office for Bulletin CGEA 6893 or write the Apparatus Department, Canadian General Electric Company Limited, 107 Park St. N., Peterborough, Ontario.

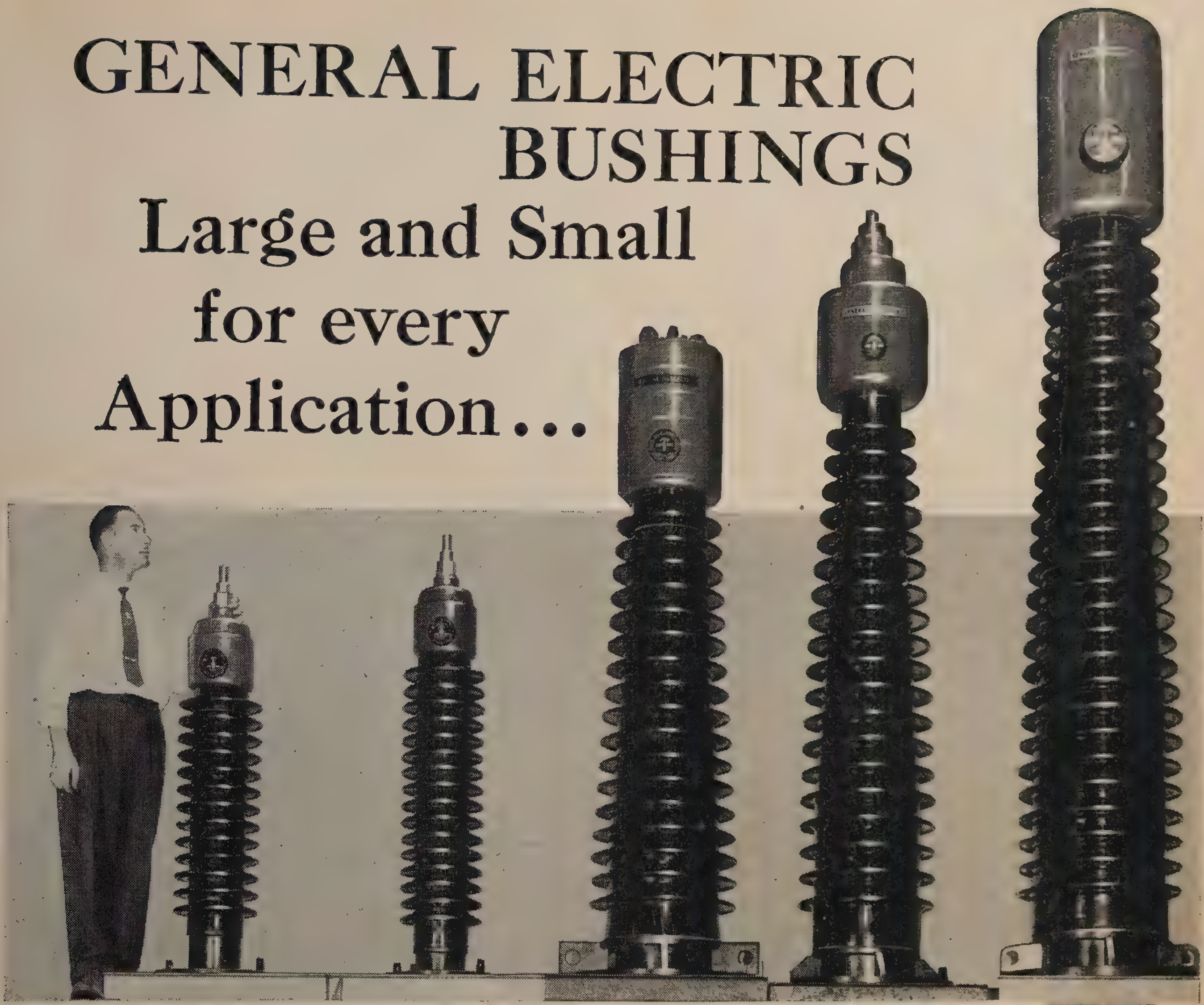
*Trade-Mark

AAD-9204-20301

CANADIAN GENERAL ELECTRIC

GENERAL ELECTRIC BUSHINGS

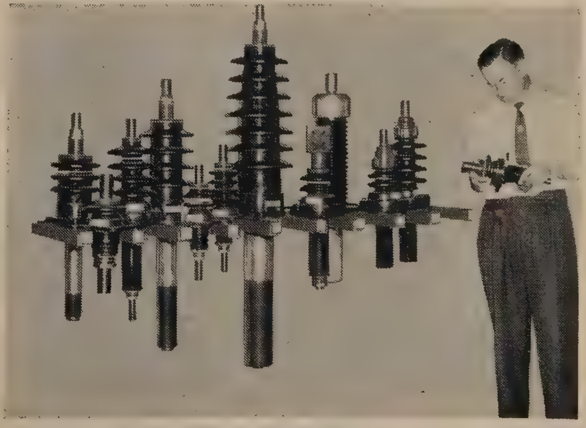
Large and Small for every Application...



Large G-E Type U Bushings range from 92 to 287.5 KV. The largest at extreme right stands over 23 feet high.

Canadian General Electric is the only manufacturer in Canada which produces a complete line of transformer and circuit breaker bushings. And, C-G-E is the first to offer a full range of bushings which conform to the new C.E.M.A. specification 1GL-1-1957.

Small to medium-sized, dry and liquid-filled bushings are always available from stock. Large, G-E Type U Bushings, rated up to 1300 KV B.I.L., are custom-built to the customer's individual requirements. Each is fully tested far beyond its normal rating before it leaves the plant, and the modern, high-speed manufacturing facilities of C-G-E's Guelph, Ont. plant permit deliveries of 4-6 weeks.



Small and medium sized G-E Bushings range from 2.5 to 69 KV. A C-G-E bushing specialist inspects the smallest. It is a dry sidewall type rated 2.5/8.7 KV, 1200 Amps.

For complete details and price information on any type or size of G-E Bushing, contact your nearest C-G-E Sales Office. For reference literature write to: Power Transformer Sales, Apparatus Dept., Canadian General Electric Co. Ltd., Guelph, Ontario.

GENERAL ELECTRIC BUSHINGS

APPARATUS DEPARTMENT

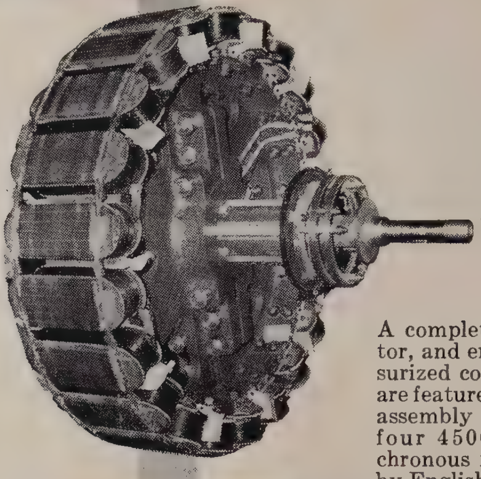
AAD-9204-28301

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

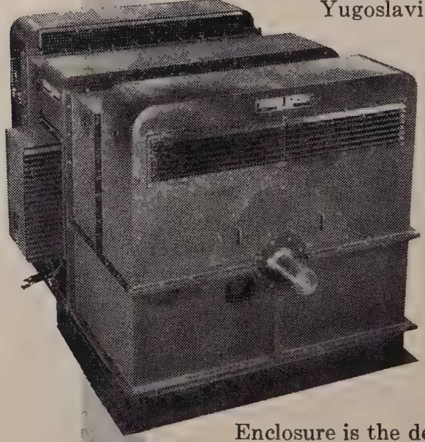
"Total" Design for Total Reliability!

Inside and out . . . in terms of duty and the conditions under which that duty must be performed, English Electric design in motors is *total* design.

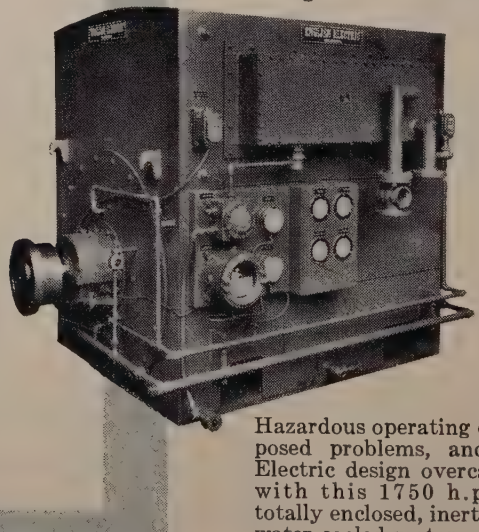
Attention to one, or a few, of the special factors involved in large rotating equipment would not be enough to ensure the highest dependability and performance. The reliability of English Electric motors and generators derives from a completely integrated design approach to all the problems of insulation, winding, bearings, balancing, and the specification and processing of all materials used to solve these problems. English Electric engineers are always seeking better materials and methods for electric motor construction. The best that are known today are used in English Electric motors now. Write for publications M611, M594, 1106, M614.



A completely split rotor, and enclosed pressurized collector rings, are features of this field assembly for one of four 4500 h.p. synchronous motors built by English Electric for Yugoslavia.



Enclosure is the design keynote of four 1500 h.p. CEMA Design II weather protected squirrel cage induction motors built for a large Canadian Utility.



Hazardous operating conditions posed problems, and English Electric design overcame them with this 1750 h.p. S.C.I., totally enclosed, inert gas filled, water cooled motor.

Buy Canadian Products And Keep Canadians Employed

A.157

'ENGLISH ELECTRIC' CANADA

MOTORS AND GENERATORS

ENGLISH ELECTRIC CANADA, a division of JOHN INGLIS CO. LIMITED

Toronto, Montreal, Ottawa, Hamilton, Winnipeg, Calgary, Vancouver and Halifax

Outdoor Switch and Bus Insulators

CP

BUILD CANADA
BUY CANADIAN

highest quality porcelain for most reliable performance

CP#9468—Station post insulators for voltage applications 7.5 KV to 69 KV.

658

LIVE BETTER ELECTRICALLY

*CANADIAN PORCELAIN COMPANY LIMITED
HAMILTON, ONTARIO

36/61

Never mind how it got there

The point is this: if your motors could operate in a controlled environment such as this, they might never need a rewind. And you wouldn't need Silastic RTV. (You probably do, you know.)

The motor in the bottle is protected against moisture, dust, dirt, corrosive atmospheres, oxidation, chemicals, and just about anything else that will degrade open frame motors. But this method of protection is not practicable.

Protection by Silastic encapsulation *is*.

When you encapsulate motors with Silastic, they're protected against all the contaminants we've mentioned plus a few more such as vibration and abrasion. Where other encapsulants will crack or craze under operational vibration and thermal expansion, Silastic RTV silicone rubber remains flexible.

Here's something else. Silastic has such excellent insulating properties that your motor will have a 25% service factor even under extremes of heat. No need to 'over-motor' for starting loads or occasional overloads.

You can encapsulate your own motors (or have your rewind shop do it) because it pours into place and sets at room temperature without costly moulds. It will save you much money and time in rewinds, maintenance and down time.

Large form wound motors can be given the same protection with a single or double wrap of Silastic Guideline Tape. This is the same silicone rubber, precision extruded in a triangular cross section with a white line to allow precise overlapping. This tape vulcanizes to itself forming a homogenous, void-free jacket of tough silicone rubber.

Guideline Tape provides a greater overload capacity, maximum resistance to factors which degrade motors as well as flexibility against thermal shock and vibration.

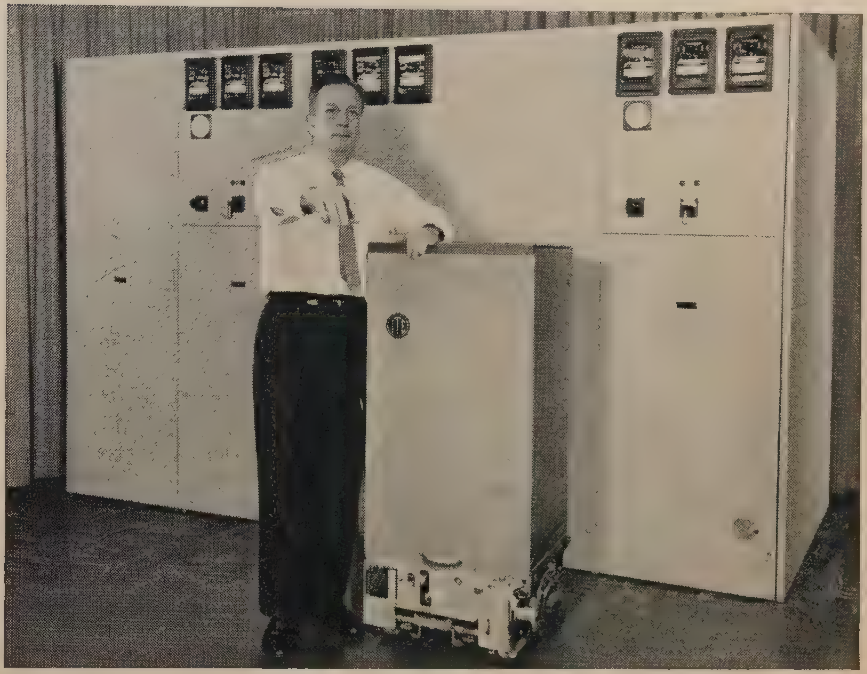
Write for brochures to: Dow Corning Silicones Limited, 1 Tippet Road, Downsview P.O.

first in silicones

Dow Corning Silicones LIMITED
VANCOUVER TORONTO MONTREAL

"......we knew you would want all these switchgear advances. And we were determined to bring them to you at the lowest possible cost."

—Frederick G. Schmidt, Manager Switchgear Division, I-T-E Circuit Breaker Company



Frankly, we had a big decision to make when we were designing this new HK metal-clad switchgear. Should we go ahead with a complete redesign or should we simply add the new features we knew you wanted to our previous models? The latter would have been easier, and it still would have put us well ahead of the field. But we decided it would be more honest to give you the benefit of as much progress as possible as soon as we could. And we were confident that in this case we could give you all these advances at a price no higher than you would pay for equipment with none of them.

First we wanted to give you stored energy closing. No circuit breaker in this class can really be called modern today without this feature. It insures that you can have fast, uniform closing every time. In fact, I-T-E makes it possible for you to close the breaker even during emergencies when you have lost control power. Fast closing reduces breaker upkeep—prolongs contact life. And I-T-E's motor-driven spring charging mechanism needs only about one-tenth the power of other devices. So you can enjoy the economy of a smaller battery or control transformer.

To give you still greater safety too—again with no increase in cost—we designed this switchgear so you never need open the doors to move the breakers. You can go all the way from connected through test position, to disconnected, and back again with the door closed. Where else can you find safety like this in metal-clad switchgear? Even an inexperienced man can operate it in complete safety. Because we were designing this equipment completely new from the ground up, we had the opportunity to make the components more accessible and provided more elbow room inside the compartments. The bus is higher, for example, making installation and inspection easier. The control cables are brought in at the front for convenience and safe access away from the high-voltage bus. The current transformers are located behind the shutter in the circuit breaker compartment and may be easily changed without disassembling the bus or cable connections.

We were meticulous from the beginning about taking full advantage of the many new materials now available for switchgear use. And through careful selection of materials, skillful arrangement of components, and shrewd economy of space, we were able to give you all these advances in a substantially smaller package as standard equipment. The gear fits under lower overheads and in narrower aisles. Yet it gives you actually more usable space inside than you had before. Circuit breakers are lower, lighter and easier to handle. Instruments are at eye level. We believe you will agree there is no finer switchgear available today anywhere.

Our HK Bulletin gives a complete description of this equipment. Write for your copy or ask to have one of our application engineers visit your office to brief your staff on its features. I-T-E Circuit Breaker (Canada) Limited, Eastern Power Devices Division, 2401 Dixie Road, Port Credit, Ontario.

Pyrotenax cables were used as feeds to all floors of the Berkley Towers Apartment Building in Vancouver.

"Pyrotenax" for an apartment building

WHY NOT?

Of course you'll find "Pyrotenax" in a well-planned apartment building, or for that matter, in any well-planned building. "Pyrotenax" is the cable you can install and forget—it comes in its own permanent, integral raceway. And it actually exceeds code requirements, yet costs no more than old fashioned wiring methods. Save time, save money, save worrying about the future—rely on Pyrotenax mineral insulated cables. You can install "Pyrotenax" indoors, outdoors, or buried directly in the ground, in hot or damp locations.

You don't wait for delivery . . . "Pyrotenax" is made in Canada!

Pyrotenax®

TYPE M.I. CABLES

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IT'S NOT JUST 90 DAYS ANY MORE

CANADIAN MARCONI NEW DT65 — SO GOOD, SO RELIABLE

GUARANTEED FOR TWO YEARS!

The new DT65 is ultra-reliable. It will work more than twice as long as the best of its predecessors, before needing service attention. Canadian Marconi's all-new design is so much better that it carries the most sweeping guarantee in mobile radio history.

Study the guarantee. The Canadian Marconi Company warrants all transistors, all diodes, all tubes—in fact, all internal component parts of the radio unit—for a full two years. (The miniature tubes have a proven minimum average life of 10,000 hours.)

Compare this guarantee with the three month warranties of other units.

DT65 reliability saves you cash. Fire and police departments, utilities and other priority services require the greatest possible reliability from mobile radio equipment. This is the fulfilled promise of the DT65. It will continue to work long after others have failed. This singular reliability saves you cash in two ways:

1. Fewer service interruptions mean lower servicing costs.

2. Fewer stand-by units are needed "on the shelf" for maintenance applications, so less capital is required.

Profit from DT65 flexibility. The DT65 can operate as anything from a single-channel up to a SIX-channel unit. In addition, it has facilities to add such items as Siren and Loudhailer, etc. Simple adaptors mean that you pay only for the flexibility you need. Just add-in as your needs grow—all the basic wiring is already there. The expansion of your mobile radiotelephone needs will *never* make the DT65 obsolete.

Remove the [illegible]
The unique DT65 TWO-YEAR GUARANTEE says more about its reliability than any technical specification could ever do. Secondly, Canadian Marconi invites you to "prove it to yourself" with our Evaluation Loan Plan which lets you be sure, by your own experience, before you commit yourself to buy.

Take your first step toward cash-saving, more reliable mobile radio. Fill in the coupon and mail it today.

Please send me:

☐ Further general information

☐ Full technical specifications

☐ Details of your Evaluation Loan Plan

☐ A Sales Engineer

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CANADIAN MARCONI COMPANY

CANADIAN MARCONI COMPANY

Commercial Products Division

2442 Trenton Avenue
Montreal 16, Quebec

Here's why it's Good Business to install Inglis 'Glasteel' Water Heaters

√ **UNCONDITIONAL 10-YEAR WARRANTY**—The Inglis Warranty promises not just an adjustment but a whole new heater in the event of a "Glasteel" tank failure at any time during the 10-year period from date of installation and only Inglis "Glasteel" Water Heaters have proved that they outlive the 10-year warranty period.

√ **EXCLUSIVE 'GLASTEEL' LINING**—The exclusive Inglis "Glasteel" lining utilizes a secret glass compound that is vastly superior to any other glass-lined tank. "Glasteel" fuses the rust resistance of specially formulated glass with the strength of steel, assuring *years* of trouble-free use beyond the warranty period.

PROVED IN OVER 200,000 CANADIAN HOMES

√ **INGLIS' COMPACT ONE-UNIT HEATERS** cut down on valuable installation time. They are packaged complete—are ready for immediate hook-up, with none of the time-consuming trouble associated with old-fashioned heaters.

√ **INGLIS AUTOMATIC ELECTRIC WATER HEATER**... eliminates element corrosion... maintains initial recovery rate... exclusive "Heetwall" channel provides easy servicing.

John Inglis Co. Limited

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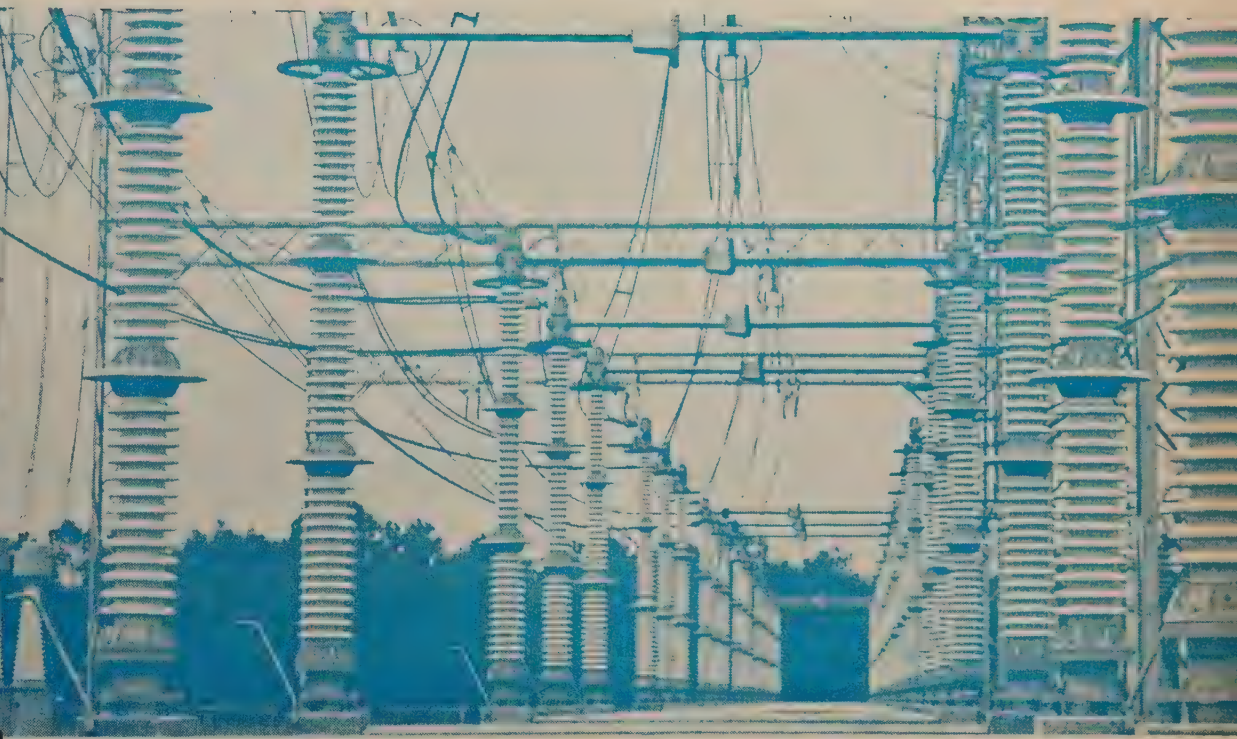
HEAD OFFICE: 14 STRACHAN AVENUE, TORONTO 3

NGK

SOLID CORE INSULATORS



Puncture-Proof Performance

Unlike conventional hollow insulators, which must be protected against moisture seepage with a sealed joint at the bottom, NGK station-post and line-post insulators are of solid-core construction, eliminating moisture seepage and resultant puncture.

This solid-core construction also makes it possible to guarantee a cantilever strength equivalent to that of conventional insulators of much larger diameter. Likewise, the slender body diameter improves anti-pollution performance.

Because of their outstanding qualities of strength, uniformity, and durability, NGK solid-core insulators are gaining in popularity throughout the world.

Cable: INSULATOR NAGOYA. TELEX: NGK-NG9928
Represented in all major territories.

Nippon Gaishi Kaisha **LTD.**
Mizuho, Nagoya, Japan

Installation time: 2 minutes!

Only Westinghouse offers A-base thermal demand meters

with the same base dimensions as standard watthour meters

Replacing a watthour with a demand meter can be awkward. But you can replace a standard A-base Watthour Meter with a Westinghouse DAH Thermal Demand Meter in two minutes—because the base dimensions are exactly the same. And it's the only one designed this way . . .

Are there other reasons for specifying Westinghouse? Yes. This compact meter has the longest 1500 watt scale on the market. This makes for easier reading and greater accuracy. Also, the Westinghouse Meter is designed so that all components are readily accessible for maintenance purposes.

That's why it makes good sense to specify Westinghouse Thermal Demand Meters—every time.

For descriptive booklet H-42-351, write to:

Switchgear and Control Division, Hamilton, Ontario
Canadian Westinghouse Company Limited

61A500

SERVING
CANADA'S
POWER
UTILITIES

Northern Electric
COMPANY LIMITED

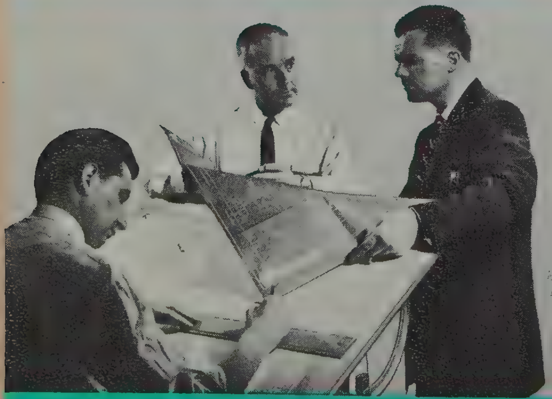
Always ready to serve YOU...

The Northern Electric salesman brings to you the widest selection of quality electrical equipment available from any *single* source in Canada. You save the time and expense of multiple inquiries, for you can select, from this single source, the items best suited to your needs from among the products of over 200 leading manufacturers of electrical equipment.

Whatever your requirements in power distribution equipment, motor control, wires and cables or lighting supplies he has the *right* product to meet the need. He takes a personal and continuous interest in ensuring that customers are provided with fast and efficient service.

Moreover, to provide a complete sales and engineering service and to assist you on highly technical products and projects, Northern Electric product specialists and engineers are also at your service. You can include them in your electrical planning when technical advice is required.

PRODUCT SPECIALISTS



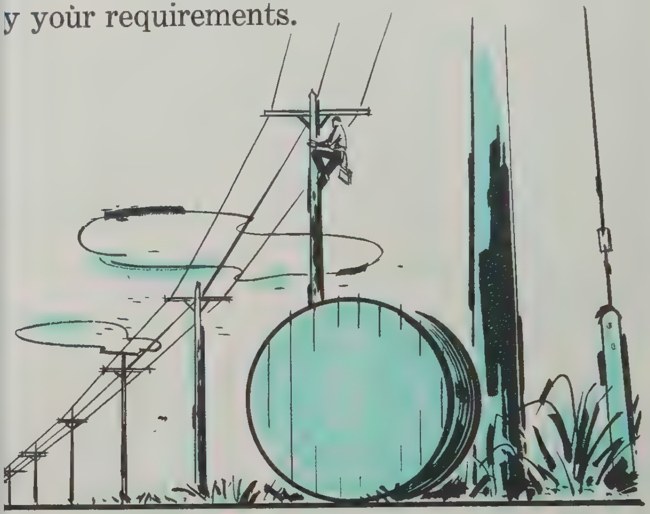
ENGINEERS

WIRES AND CABLES

ern Electric manufactures every type of wire able used by Power Utilities to provide their service to consumers.

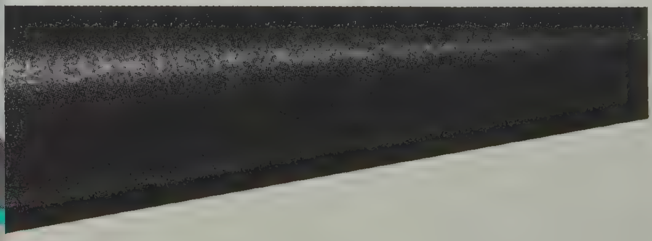
ntinuously increasing electrical loads demand power cables be completely reliable. Our more 60 years manufacturing experience and rn production, inspection and laboratory ies *are your assurance* of the highest quality.

ether your need is for a low voltage cable or -high tension oil-filled pipe cable, we can y your requirements.



D.Q.' CONDUIT

otection for underground cables



rnwall's impermeable walls and self-sealing sleeve joint provide complete protection destructive ground waters.

rnwall's accurately machined, smooth joints ow co-efficient of friction keeps pulling ten- to a minimum and protects against cable h abrasion.

N. SLATER LINE PRODUCTS

Construct with Confidence...

Few indeed are the users of pole line hardware who are not familiar with the Slater name and its many dependable products.

Slater products are designed to exacting standards based on and backed by 48 years manufacturing experience. They are your assurance of top performance. There are always new and improved items being developed with the result that every need on the line can be filled with a Slater product.

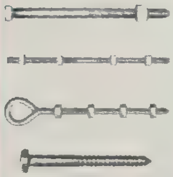
Specify Slater for *all* your power line construction materials.

ANCHORING DEVICES

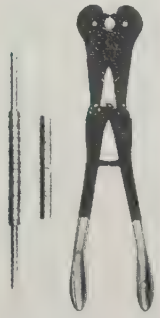
FleXall CLAMPS

CROSSARM PINS

TRANSMISSION HARDWARE


POLE HARDWARE

MAXAMP CONNECTORS


NICOPRESS SLEEVES & TOOLS

PREFORMED GUY-GRIP dead ends

PREFORMED Splices

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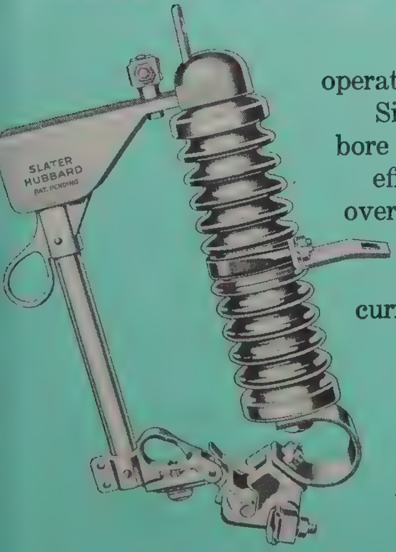
SLATER-HUBBARD Cutouts and Lightning Arresters

FAULTMASTER CUTOUTS

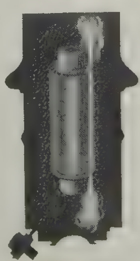


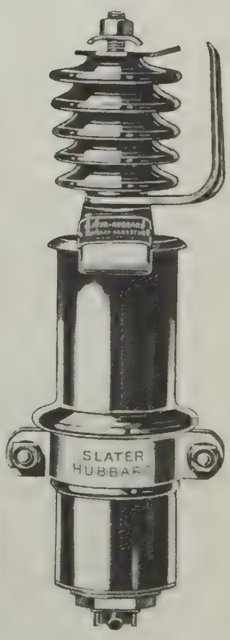
for safe cutout operation at all levels. Single-vent, small bore design ensures efficient operation over its entire range from the lowest overload current up through its maximum interrupting capacity. The safest, most positive load interrupter available.

AUTOGAP LIGHTNING ARRESTERS

Unique design provides more protection — longer life. The Slater-Hubbard Autogap Lightning Arrester, through years of model service and efficiency, has become synonymous with ruggedness, endurance and effectiveness.

"Magic Cylinder" Offers multiple discharge paths to surge currents . . . prevents burning and deterioration . . . dissipates gas pressures quickly and harmlessly through twin exhausts.



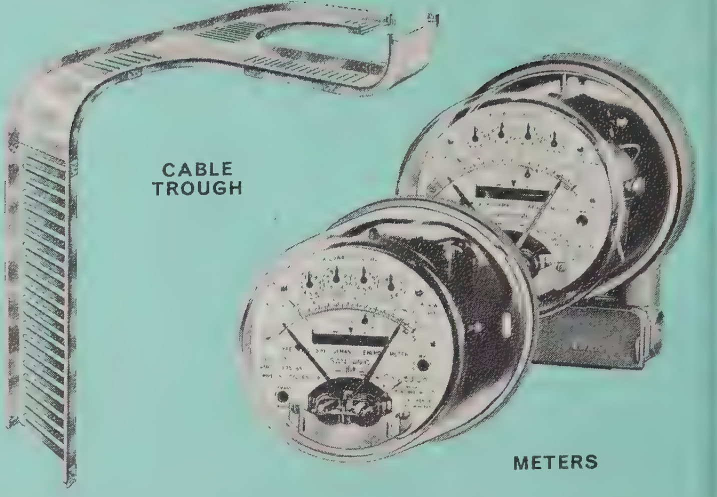


CANTROUGH CABLE TROUGH

The most flexible and versatile construction in the trough system of cable distribution. Due to its *superb* design and relatively simple erection, installation cost is kept to a minimum.

SANGAMO METERS

A complete line of meters for the measurement of polyphase circuits. Combination demand energy meters, Indicating demand meters, Polyphase Watthour meters, meters for system betterment.



G. & W. POTHEADS

A wide variety of standard types and sizes for high voltage cable. Each has been especially designed to *best* meet the requirements of conventional installation methods and most common applications.

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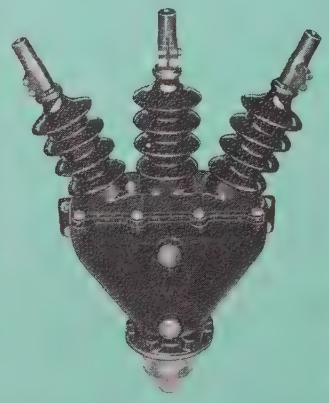
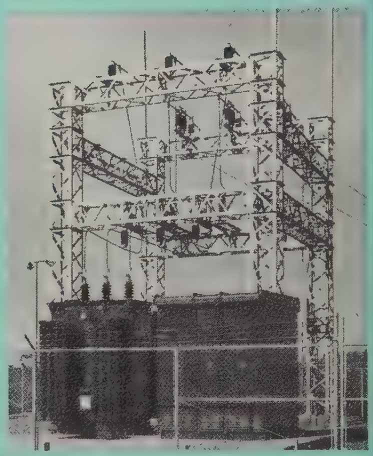
Outstanding design based on specialist experience is your assurance of *highest* quality and trouble-free performance. Particular emphasis is placed on *ease* of installation and on meeting whatever may be your special requirements for growth and relocation.



POTHEADS



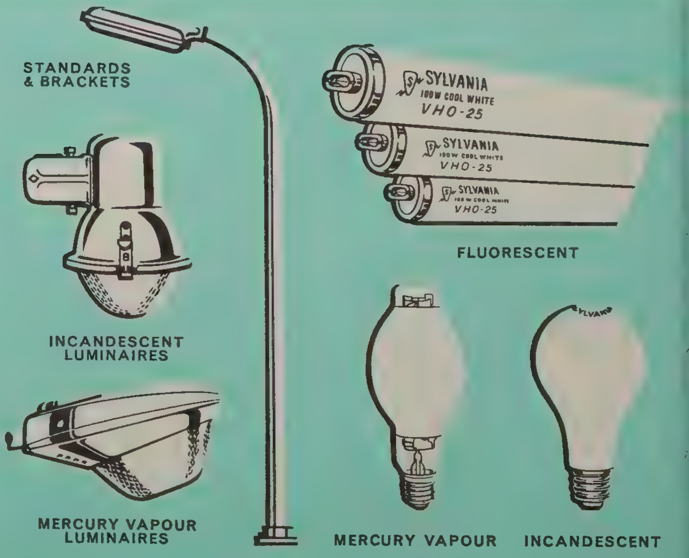
SUBSTATIONS

POWERLITE LUMINAIRES

Powerlite Luminaires are in use in almost every part of Canada. Precision designed and ruggedly built to give many years of *reliable* service — available in a wide range, including standards, poles and control equipment.

SYLVANIA LAMPS

In every application — interior or exterior — where better light at *lowest* possible cost is a prime consideration, Sylvania lamps meet the test. They give more light per watt, with longer lamp life and fewer lamp failures.


STANDARDS & BRACKETS
SYLVANIA 100W COOL WHITE VHO-25
SYLVANIA 100W COOL WHITE VHO-25
SYLVANIA 100W COOL WHITE VHO-25
FLUORESCENT
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NEWS OF THE INDUSTRY

BCE buys control of Peace River Project consultants

British Columbia Electric Company Ltd. has obtained control of International Power and Engineering Consultants Ltd. by acquiring 80% interest of the half interest owned by Balfour, Beatty & Co. Ltd. BC Electric will take over immediately the control and operation of the firm.

The consulting firm was formerly B.B. and B.C. Power Consultants Ltd., and has been in charge of all the engineering on the Peace River Project since 1958.

BC Electric said the arrangements for the takeover were made before its expropriation by the provincial government.

A statement said the acquisition will "speed up work on the Peace River hydro scheme by utilizing work already done by IPEC."

BC Power Corporation, from which BC Electric was expropriated, still has half interest in IPEC and says it will hold it for the time being. BC Electric now holds five of the eight seats on the board of International.

International Power and Engineering Consultants also has a continuing contract for all of BC Electric's normal engineering and consulting work in addition to the Peace River project.

Electrical caravan informs rural customers

A latter-day version of Sir Adam Beck's circus caravan is travelling around Ontario. It carries a variety of modern electrical appliances to cities, towns and rural districts. In this way, the Hydro Commission offers its customers up-to-the-minute information on the newest applications of electricity and the latest trends in electrical living.

The vehicle contains 250 square feet of floor space which can be increased by an additional 175 square feet of platform by means of three hinged sections at the left side. The telescoping roof slides out seven feet to form a canopy over the platform, which can be separated from the displays for special events.

Every square foot of space is used to advantage, to exhibit displays of electric heating and water heaters, and the latest modern electrical appliances for kitchens, laundries, workshops, and farms. Manufacturers' models are rotated regularly.

Colour psychology topic at Toronto IES meeting

The Toronto section of the IES will hold a joint meeting with the Residence Lighting Forum on December 4 at Malloney's Art Gallery.

Mrs. Eleanor Brown, interior decorator with Robert Simpson Company, will speak on "Colour Psychology in Everyday Living."

IPEC president resigns and forms new consulting firm

The president of International Power and Engineering Consultants Limited, Dr. Thomas Ingledow, has resigned.

He announced the formation of a new consulting firm, to be known as Ingledow Kidd & Associates, shortly after BC Electric bought control of IPEC.

Dr. Ingledow, a former president of Canadian Electrical Association, stated that the new company will engage in general engineering in Canada and other parts of the world. Concentration will be in the fields of hydro- and thermal-electric generation, electrical transmission and commercial buildings.

Prior to the formation of the new firm, Dr. Ingledow was president of BC Engineering Ltd., a precursor of IPEC, and a vice-president of BC Electric. Latterly, he directed the engineering of the Peace River Power Development.

Westinghouse to build generators for Little Long

A $1,500,000 contract has been awarded by Ontario Hydro for two power units at the Little Long generating station on the Mattagami River.

Canadian Westinghouse Co. Ltd., will supply both generators, which will have a combined output of 114,000 kilowatts. Two other companies bid for the contract.

The Little Long Project, 42 miles north of Kapuskasing, is scheduled for completion in late 1963. The station is one of three to be built along a 15-mile stretch of the Mattagami which will supply 356,000 kilowatts of power by 1966.

New Brunswick orders turbo-generators for Grand Lake

The New Brunswick Electric Power Commission is reported to have ordered a 60-megawatt turbo-generator from C. A. Parsons of Canada Ltd. for an extension of the existing thermal station at Grand Lake.

Parsons is the main contractor for the job. Foster Wheeler Ltd. will provide a 40,000 sq ft condenser, complete with air ejector and condensate extraction pumps, and also feed-heating plant and all inter-connecting piping and instrumentation.

Peace River pilot tunnel and bridge contract awarded

Contracts for bridge and pilot tunnel at the Peace River power project site near Fort St. John have been awarded by BC Electric.

Western Bridge and Steel Fabricators Limited, Vancouver received a $300,000 contract to build a single lane bridge across the Peace River canyon.

McNamara Construction of Edmonton received a $240,000 contract to drive a 10 x 10 foot tunnel 2,500 feet through the west bank of the Peace near the damsite.

The tunnel is being driven to explore rock formations under the river. Starting in February, three 50-foot diameter, 3,000-foot long diversion tunnels will be drilled.

The pilot tunnel will help contractors examine construction problems which may affect their bidding for the main tunnels. The pilot tunnel will later become part of a larger diversion tunnel.

The steel-arch bridge will reach 500 feet across the canyon. Both projects will start immediately and will be completed February, 1962.

Industrial Electrical Exhibition held in Niagara Falls

Top left—Entrance to Industrial Electrical Exhibition, Brock Hall, Niagara Falls; right—row of exhibitors including CLM, Westinghouse, Ferranti-Packard, Sylvania; bottom left—English Electric representative listening to a question about equipment; right—Pyle-National exhibit.

Modern electrical devices were on display for industrial users at Niagara Falls October 11-14 .

The Industrial Electrical Exhibition, sponsored jointly by industry and 14 local municipal utilities and Ontario Hydro, was the first of its kind in the province.

The exhibits were aimed at senior management of industries in the area. The purpose was to help executives and other senior personnel become aware of modern industrial applications of electricity. In recent years, the pace of development has been so rapid that only those associated with the electrical field were aware of all the new types of electrical equipment available.

Approximately 25 manufacturers exhibited their most up-to-date products including lighting, heating and communications equipment.

A. M. Bizzell of Ontario Hydro, and the man responsible for the organization of the show, said that it was an experiment in communication between senior management in industry and manufacturers of electrical equipment.

R. M. Armstrong, DeVilbiss (Canada) Limited, feels that the exhibition helps manufacturers in two ways. "We have an opportunity to present the idea of our own products to the right people," he said, "and we also see many new electrical products and techniques which have applications in our production processes."

Throughout the period of the exhibition, maufacturers' representatives were on hand to demonstrate and explain equipment and their applications.

Informal technical addresses and films were held in conjunction with the show.

Plantpower program completely revised

A complete revision of the highly successful Plantpower program has now been completed by leading systems engineers of Canadian electrical manufacturers and utilities. The training seminar for electrical contractors, superintendents and consultants has been expanded to two full days, with considerable in-plant assignments.

A ready-to-use lecturing and promotion kit for the new program is now available to sponsoring utilities. Several utilities have already scheduled the new program for their industrial customers before the year end.

Material for the entire program is available from the Electrical Bureau of Canada, 126 Davenport Road, Toronto 5. Lecturing kits available on loan to sponsoring utilities. Promotion material to ensure attendance, available at no charge. A complete manual including a handy calculator, issued to each participant at printing cost.

Many of the 2,500 electrical experts who have attended previous seminars — and have begun to apply this method in their plants — are planning to return for the expanded seminar training. Other corporations who have heard of the successful surveys conducted by leading corporations are planning to send representatives for the first time.

Engineering unification conferences aid world trade

"American-British-Canadian Engineering Unification conferences are necessary for the conduct of peaceful world trade," said standards engineer R. P. Trowbridge of General Motors at the National Conference on Standards held in Houston, Texas, in October.

"ABC standards recommendations would facilitate future joint emergency production programs and avoid the magnitude of difficulties encountered by member nations in World War I and II," Mr. Trowbridge said.

New areas of study suggested at the 1960 steering committee meeting of the ABC included symbolization and drafting practice in electrical engineering work, terminology, material specification and decimalization of the inch.

Asserting that the ABC program has been "valuable in aligning the viewpoints of technical people," the standards engineer recommended that full-scale ABC meetings be held at least every two years or more frequently if the pace of development quickens.

Niagara generators retired after 66 years of service

The world's first commercial alternating-current generators, rated at 4000 kw each, will soon spin to a halt at Niagara Falls after producing billions of kilowatt-hours of electricity during the past 66 years. Made in the early 1890's by George Westinghouse, founder of Westinghouse Electric Corporation, the ten units are located in the Adams Station No. 1 of the Niagara Mohawk Power Corporation.

Near the Dean Adams Station is the new Robert Moses Niagara Power Plant which has 13 of the western world's most powerful water-wheel generators—rated at 150,000 kw each —also built by Westinghouse.

Canadian engineer appointed to direct Volta River project

An Ontario Hydro engineer will direct Ghana's massive Volta River power project.

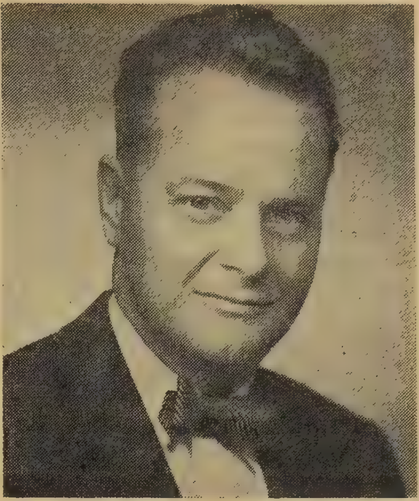
Frank J. Dobson, 44, construction manager of Hydro's $250 million Lakeview thermal-electric development, on the western edge of Metropolitan Toronto, has been named chief executive of the new Volta River Power Authority by Ghana president Kwame Nkrumah. Mr. Dobson and his family leave for Accra early next month. He will be on loan from Hydro until the project is finished probably in four or five years.

W. Ross Strike, Hydro Chairman, said Mr. Dobson "is one of Hydro's outstanding construction engineers." He said President Nkrumah had asked Prime Minister Diefenbaker for a Canadian to head the Volta Authority. The request was passed on to Premier Frost and then to Mr. Strike, who asked Mr. Dobson if he was interested in the job.

"Ontario Hydro believes that development projects of this nature deserve the fullest support by Canadians. We are pleased that Mr. Dobson, in common with other Hydro employees who have made similar contributions in the past, has seen fit to accept this responsibility," Mr. Strike said.

Essentially the Volta River power scheme involves building a big (2,100-feet-long, 375-feet-high) rock dam, a complementary saddle dam nearby, and a powerhouse with four 128,000-kilowatt generators at Akosombo, 68 miles northeast of Accra, the capital. The powerhouse will be designed for an ultimate capacity of 768 Mw. Ghana's present electrical output is about 100 Mw from diesel-electric generators.

Major consumer of the plant's power will be an aluminum smelter to be built at Tema, Ghana's seaport, close to Accra. The plant will also supply industrial and residential power needs in southern Ghana.



Frank J. Dobson

Cost of the Akosombo scheme is nearly $170 million. This includes dams and powerhouse, generating equipment, a village and hospital for construction workers, and transmission systems.

Ghana is providing half the funds. The rest is being negotiated but is expected to come from the World Bank, the United States and the United Kingdom.

An Italian consortium several months ago won a $44 million contract for constructing the two dams and the powerhouse. Engineers from the Kaiser organization in the United States have completed preliminary surveys at the site, design work, and contract specifications. They will oversee work in the field and report to Mr. Dobson.

When the Akosombo dam backs up the waters of the swiftly flowing Volta River, it will create a 3,500 square mile lake which will displace 65,000 persons.

As well as directing construction, Mr. Dobson will be responsible for the relocation program before the lake is created. As chief executive of the Volta Authority, he will be in charge of finances, and will cope with downstream effects when the Volta is dammed and a host of other details.

Mr. Dobson has almost 20 year of experience in hydro-electric developments in Ontario. He joined Hydro in 1942 and climbed quickly through the ranks. He was a divisional engineer at the DeCew Falls power project in his first few years with Hydro, then became field project engineer at the Chenoux hydro-electric development on the Ottawa River in 1948.

Four years later, he was posted to Niagara as divisional engineer on the second Sir Adam Beck power plant. In 1954 he was named field project engineer there and in May, 1957 was made manager of the entire development.

In the spring of 1958 he was appointed construction manager at Lakeview, while continuing to direct the last stages of work at Niagara.

Strengthen Laprairie line

Hydro-Quebec has announced plans to strengthen the Laprairie-St. Maxime transmission facilities, Canadian Comstock has been given the contract to build an eight mile, 120-kv, steel tower transmission line between the two centres.

Canadian Bridge Works has been given an order for $500,000 worth of galvanized steel towers for a 300-kv transmission line from Saraguay to Bout-de-l'Ile.

TCA computer reservation system installed

Trans-Canada Airlines' new electronic reservations system in Toronto will speed ticketing procedures and reduce chances of error to a minimum. The system, called ReserVec, will go into operation early in 1962. The three magnetic tape drums in the foreground store information for the twin computers in the large cabinet to the left in the picture. The four magnetic tape cabinets store the majority of information about future flights which do not require instantaneous reply. From the centre console, one man can monitor the entire registry system. ReserVec cost $3 million and was built by Ferranti-Packard Electric, Toronto. CN Telegraphs will maintain the field equipment.

P.E.I. will get additional 20-kw steam generating unit

The Maritime Electric Company Limited of Charlottetown has announced plans to purchase and install additional generating equipment within the next two years which will cost more than two and a half million dollars.

A. D. Cameron, general manager, states that the company is quite confident that future development in industry, as well as in agricultural areas and communities, will justify the proposed investment.

At the present time the total installed capacity of the Charlottetown steam electric plant is 32,500 kilowatts, which includes the new turbine and generator of 10,000 kilowatts commissioned in 1960. The planned 20,000 kilowatt unit will be twice as large as any now in use at the Charlottetown plant, and will be capable of increasing the plant's output by over sixty percent.

The new turbogenerator will be built by Associated Electrical Industries Ltd., of Mancheseter, England. It will operate on twice the steam pressure of the present units in the Charlottetown plant: 850 pounds per square inch, at a temperature of 900 degrees, and it is expected that a marked increase in efficiency will result from this advance in steam pressure and temperature. Because of the length of time it takes to build a large turbine of this type, the order has already been placed with the manufacturers, in order to have it in operation by September of 1963.

The new oil-burning boiler has been ordered from Babcock-Wilcox and Goldie-McCulloch Ltd., of Galt, Ontario, and will be capable of evaporating 190,000 pounds of water per hour.

To accommodate the new unit the entire west end of the Charlottetown plant will be extended to the boundary of Cumberland Street. Engineering for the new installation, and designs and specifications for the plant extension are now being prepared by the Montreal Engineering Company, Limited.

Previous to deciding to install the new unit, Maritime Electric officials met with the New Brunswick Electric Power Commission to discuss an alternative means of obtaining additional electric power. These discussions arose from the close association of the two utilities in the Power Committee of A.P.E.C.

This alternative method was to obtain power from the mainland at certain times by means of an interconnecting submarine cable between P.E.I. and New Brunswick. This interconnection was deemed to be feasible from the engineering point of view in a study carried out using the University of New Brunswick's digital computer.

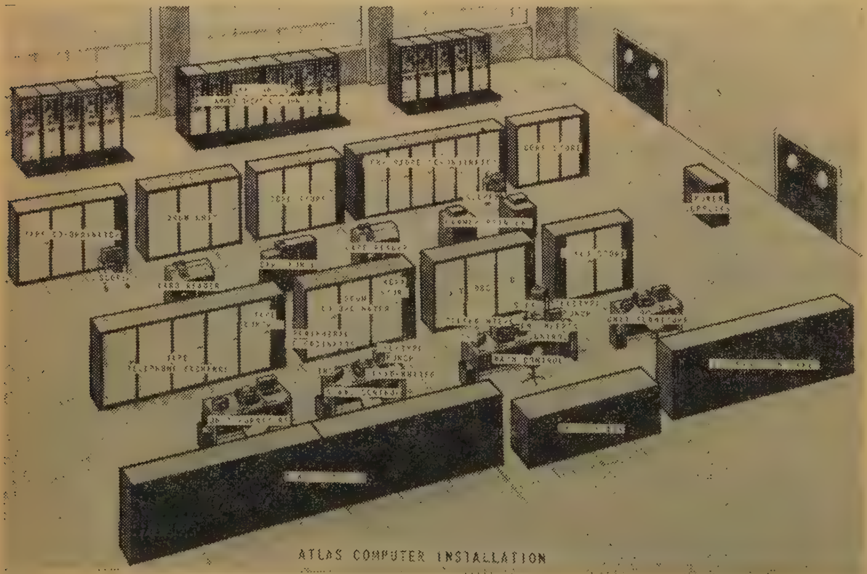
The results of estimates, however, showed that service to Island customers could at the present time be maintained more economically if the local company intalled the additional unit in Charlottetown.

However, the meetings and discussions did bring forth the possibility that, should a causeway be built between the Island and the mainland, an overhead transmission line connecting the power systems of Prince Edward Island and New Brunswick might be advantageous.

The rapid expansion of the company during the past few years has been brought about by an unusual increase in the use of electric power in P.E.I., not only in the urban areas, but especially in the rural sections. The rapid expansion of service to the rural areas under the Prince Edward Island Government's Rural Electrification Program has resulted in electric power now being used by more than eighty percent of Island farms, a ratio which is not even equalled in Great Britain.

Installation of the new turbine and boiler will commence late in 1962, with commissioning of the new unit scheduled for September 1963.

# Ferranti-Packard may build Atlas computer in Canada



Ferranti-Packard (England) has received two orders for their giant Atlas computer. The U.K. Atomic Agency and the University of London have ordered the computers.

The U.K. Atomic Agency will use the Atlas Computer for scientific calculations to speed its nuclear research program. The University of London is being given initial support by the British Petroleum Company, which is advancing approximately one-quarter of the cost. The university will employ the computer in fields such as crystallography, study of aircraft and civil engineering structures, weather forecasting, linguistic analysis and mechanical translations.

It has been reported that Ferranti-Packard is actively considering Canadian production of this mammoth computer for the North American market.

Large contract for Manicouagan awarded

One of the largest single contracts to date for the huge Manicouagan river power development has been awarded to Janin Construction Ltee. Hydro has placed a $2.8 million order with Janin, one of eight competing companies. The contract is for the design, supply, transportation and erection of a system for conveying concrete by means of cables for the multiple-arch reservoir dam.

Since the dam's length is some 4,200 feet and its height more than 700 feet, special equipment is needed for transporting and placing the concrete—2.6 million cubic yards of it.

Swedish hydro dam claimed to be atom-bomb proof

An atom bomb-proof dam has been built in Sweden on the Osterdälaven River at Trängslet. Swedish engineers decided to use rock-fill rather than concrete for military reasons, since the rock-fill type dam is claimed to resist even atom bombs.

The new 300-Mw hydro-power plant has Sweden's highest, and one of the world's biggest, rock-fill dam. The $33 million plant, in west central Sweden, was built by the steel-forest-mining complex, Stora.

An artificial lake stretches 30 miles from the dam along the river valley to Säna Lake. In places the lake is deeper than the Baltic Sea. Although some 8,000 acres of forest land have been flooded, no human settlements and only a small area of arable land, along Särna Lake, have been affected.

The dam rises to a height of more than 400 feet and is 2700 feet long. Volume of fill is more than 7.2 million cubic yards.

Two Francis turbines of 140,000 hp each power the generators which were supplied by Asea.

Rock-fill dam of the new 300-Mw Swedish hydro-electric plant

Grand Rapids generator order placed with CGE

Canadian General Electric has received an order for generating equipment worth more than $3,000,000 for the Grand Rapids hydro-electric development now under construction in northern Manitoba.

Three 115,000-kva hydro generators will be built for the development, located on the Saskatchewan River some 250 miles north-west of Winnipeg.

Among the largest units ever built by CGE, the three generators — each weighing 770 tons — will be delivered in 1963 and 1964. They will provide the equivalent of one year's work for 100 men at the firm's Peterborough plant. In operation, the three units will produce about 500,000 horsepower for Manitoba consumption.

BC Hydro takes over Vancouver Island system

The BC Power Commission will take over operation of the Vancouver Island Division from BC Electric early in 1962. At the same time, BC Electric will take over areas and communities in northern British Columbia now served by the Commision.

BC Bridge River-Cheekye line in operation

Power is flowing for the first time over 85 miles of new transmission line between BC Electric's Bridge River generators and Cheekye substation, 40 miles north of Vancouver.

The Cheekye terminal was already the meeting point of electric energy from Bridge River via existing 230-kv line end from two other hydro-electric generating stations, Cheakamus and Clowhom. Power is routed over existing circuits from Cheekye to the lower mainland.

The new Bridge River-Cheekye line, built for 360-kv service, is operating initially at 230 kv. It cuts through muskeg valleys and up rugged mountain sides to give the lower mainland a third high voltage link with 492 megawatts of generating capacity at four Bridge River power stations.

Westinghouse-Univac to develop computers

A jointed development program in control systems has been undertaken by Westinghouse and Remington-Rand. Under the joint agreement, Remington-Rand, through its Univac division, and Westinghouse will develop an advanced line of computers for the process control field, which will combine industrial and business data processing systems. Both companies will continue independent research in their specific fields.

The complete control system is expected to be of interest to generating stations, refineries, steel and paper mills, and other industries where integrated control would be advantageous.

British group sets up new company in Canada

Metal Industries Limited, a British electrical engineering group, is setting up a new company in Canada. The company's director of marketing, R. J. F. Howard, said that Dominion M.I. Limited was being formed following the dissolution of Bepco Canada Limited, a consortium of British electrical manufacturers.

Dominion M.I., which began operations on November 1, has its head office and works in Montreal and a branch office and repair department in Toronto.

The new company will be concerned with the promotion of the M.I. Group's products in the Canadian market and with the manufacture of specialized electrical control systems and equipment. President and general manager of the company is E. A. Chandler, and general sales manager is D. J. Tamblyn.

Iced concrete helped build leakproof reactor building

Mixing ice into concrete enabled Ontario Hydro to build crack-free walls for the Douglas Point reactor building.

The thick walls of the circular reactor structure, which is 135 feet high and 130 feet in diameter, had to conform to rigid specifications calling for leakproof building.

This posed a problem, because when concrete is placed at high temperatures there is a greater possibility of cracks developing as it cools.

The solution was crushed ice, delivered to the site by a local supplier, and mixed with the concrete to keep the temperature down.

About 1,100 cubic yards of concrete were mixed in this fashion, and the crack-free condition of the walls attests to its effectiveness.

The walls were constructed of long and short segments, placed alternately. The long segments were placed first and allowed to cool to the temperature of the aid. To keep shrinkage in the shorter filler segments to a minimum, a placing temperature of 50 to 55 degrees F. was required.

This was achieved by using ice and water in varying proportions, depending on the temperature of the air. The crushed ice melted during mixing and lowered the initial placing temperature to the required level.

Initially, the mixing proportions were about two-thirds water and one-third crushed ice. Ultimately, as air temperatures increased, only ice was used.

To further increase the effectiveness, most of the ice-cooled concrete was placed at night when air temperatures were lower.

The method may be employed again at Douglas Point next year for concrete in the reactor vault, and may be useful on future projects.

Helicopter used to extend island power line

Ontario Hydro used a helicopter to airlift and place poles in an area unaccessible by road. Twelve poles, each weighing 800 pounds, were transported a distance of twelve miles—three over water—between Penetanguishene and Bone Island in Georgian Bay. The Sikorsky S-55 picked up a pole in four minutes, flew with it to Bone Island in twelve minutes, and hovered for two minutes while workmen secured the pole in the ground. This was the first full-scale operation of its kind undertaken by Ontario Hydro. They report that this method saved both time and money.

APEO sets up 30 chapters throughout province

Thirty chapters of the Association of Professional Engineers of Ontario have already been established in areas throughout the province, says T. M. Medland, executive director of the APEO.

They are designed to bring about an improved system of communications between the Association and its membership. The APEO has grown in 15 years from a compact organization with 4,000 members to a widely-dispersed body of 20,000 in all parts of the province.

Creation of the chapters is expected to result in greater participation by the membership in the Association's activities.

Federal government orders generators for Arctic

Contracts totalling $53,600 have been awarded by the Department of Northern Affairs and National Resources to two Ottawa companies for the supply and installation of electric generating equipment in three northern communities.

General Supply Company of Canada has a $34,600 contract for six 25-kw generators.

A $19,000 contract for two 50-kw generators went to Mechron Engineering Products Ltd. The generators will be installed in Arctic Bay, Hall Lake and Eskimo Point.

COMMENT

"We must face reality and decide what to do"

Comments from an address by W. Ross Strike, chairman of Ontario Hydro, to the Toronto Electric Club on Wednesday, October 18: —

In order to get oriented, it may not be amiss to swiftly recall events in the electrical industry during the last 15 years which some of us may have forgotten in our present misery.

At the end of the war, there was not the traditional slump that occurred after other wars that was confidentially expected in both high and low places.

Here stood the electrical industry in a more luscious environment that even its most optimistic planners could ever dream — in a great untapped reserve of savings along with an artificially created scarcity of all things electrical.

There was no question of cost, tight management or salesmanship and very little competition. It was just a matter of turning out the goods for eager customers. We met this demand with plants, which we had no time to modernize, although we expanded capacities as and when we could and most came a little too late for their full effect.

I am sure that many of us realized we were riding "high" on a very big wave, but it was so exhilarating, exciting and comfortable that we postponed thinking about the trough that always lies just beyond any wave, large or small.

We now realize that nature still operates and our special wave has disappeared and we must face reality and decide what to do.

We all know that the devastated places now again flourish aided by new modern plants and equipment and well-trained personnel.

The marketplace is fast developing new techniques. New alignments have and are developing between buyer and seller.

World conditions are changing fast. Those of you who have travelled abroad in the past three years need not be told. Those of us who believe there will never be an era of advancement that will match the last fifty years are living in a dream world.

I venture to make what I hope are fairly simple suggestions for your consideration and I hope later, but not too much later, action.

First, take a look where it may hurt the most — right at your own organization and not just the other fellow's price lists.

Second, surely if our former markets appear to be disappearing, there certainly are some new markets in this expanding world if we will only devote some intensive study, imagination and risk to discover and promote them.

Third, it becomes increasingly evident that we are approaching a closer relationship between management and labour.

If we are going to play in the big league of world markets, we must perform like big leaguers.

The trend of working as a team has now been started by George Romney of American Motors and the whole automobile industry has been pushed into it. Neither management nor labour were ready for it as evidenced by the plant strikes that have followed negotiations.

It is realized at Ontario Hydro that we are not set apart in these conditions. I remember when it was the smart thing to loudly proclaim that we were in the business of supplying electric energy and not selling it. Now we spend considerable money and energy in learning how to sell effectively.

COMING EVENTS

NOVEMBER

8th ANNUAL MEETING OF CANADIAN SECTION INTERNATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. King Edward Hotel, Toronto, Nov. 17-18.

DECEMBER

CANADA'S POWER SHOW. Toronto, Dec. 7-9.

JANUARY

CANADIAN ELECTRICAL ASSOCIATION EASTERN ZONE MEETING. Niagara Falls, January 22-25.

PLANT ENGINEERING AND MAINTENANCE SHOW. Convention Hall, Philadelphia, January 22-25.

ELECTRICAL ENGINEERING EXPOSITION, New York Coliseum, New York City, USA, Jan. 29-Feb. 2, 1962.

FEBRUARY

ELECTRICAL WEEK. Theme — Electricity Powers Progress. February 11-17.

MARCH

CANADIAN ELECTRICAL ASSOCIATION WESTERN ZONE MEETING. Saskatchewan Hotel, Regina, March 20-22.

MAY

CANADIAN NUCLEAR ASSOCIATION ANNUAL CONFERENCE. Chateau Laurier, Ottawa, May 28-30.

REGULAR MEETINGS

ELECTRIC CLUB OF MONTREAL. Each Wednesday, luncheon meeting, Queen's Hotel.

ELECTRIC CLUB OF TORONTO. Each Wednesday, luncheon meeting, Royal York Hotel.

ELECTRIC CLUB OF VANCOUVER. Each Friday, luncheon meeting, Hotel Vancouver.

ELECTRIC CLUB OF CALGARY. Second Thursday of month, luncheon, Beacon Hotel.

ELECTRIC CLUB OF OTTAWA. Second Wednesday of every month, 6.00 p.m. La Paloma restaurant.

ELECTRIC CLUB OF EDMONTON. First and third Tuesday of month, luncheon meeting, Airlines Hotel.

NIAGARA DISTRICT ELECTRIC CLUB. Second Wednesday of month, Royal Connaught Hotel, Hamilton.

PERSPECTIVE on the Nation's Business . . . . . by Dr. E. C. Sievwright

ECONOMIC RESEARCH CORPORATION LIMITED

A look ahead into the balance of 1962

The general upturn in business conditions from their first quarter low is now documented by the national accounts for the second quarter of 1961. The annual rate of gross national product (seasonally adjusted) in the second quarter was $36,280 million, or 1.7% above the $35,668 million rate reached in the first quarter. This was still somewhat less than the $36,436 million rate reached in the final quarter of 1961.

Consumer spending, government spending and exports increased, while new residential construction and business spending on new machinery and equipment declined. Imports of goods and services dropped by $300 million (annual rate, seasonally adjusted), but one factor behind this decline was a $196 million fall in the rate of dividends and interest paid to non-residents. This component was the key explanation for the $236 million import rise in the first quarter, when a sudden jump in these payments place.

A second distorting factor in the overall G.N.P. picture in early 1961 appears in changes in the value of farm inventories (and grain in commercial channels), which will swing from moderate accumulation in 1960, to heavy liquidation in 1961, as a result of widespread Prairie grain crop failures. Allowing for both these unusual factors, the rate of G.N.P. advanced fractionally between the last quarter of 1960 and the first quarter of 1961, and rose at a rate of $600 million between the first and second quarter of this year.

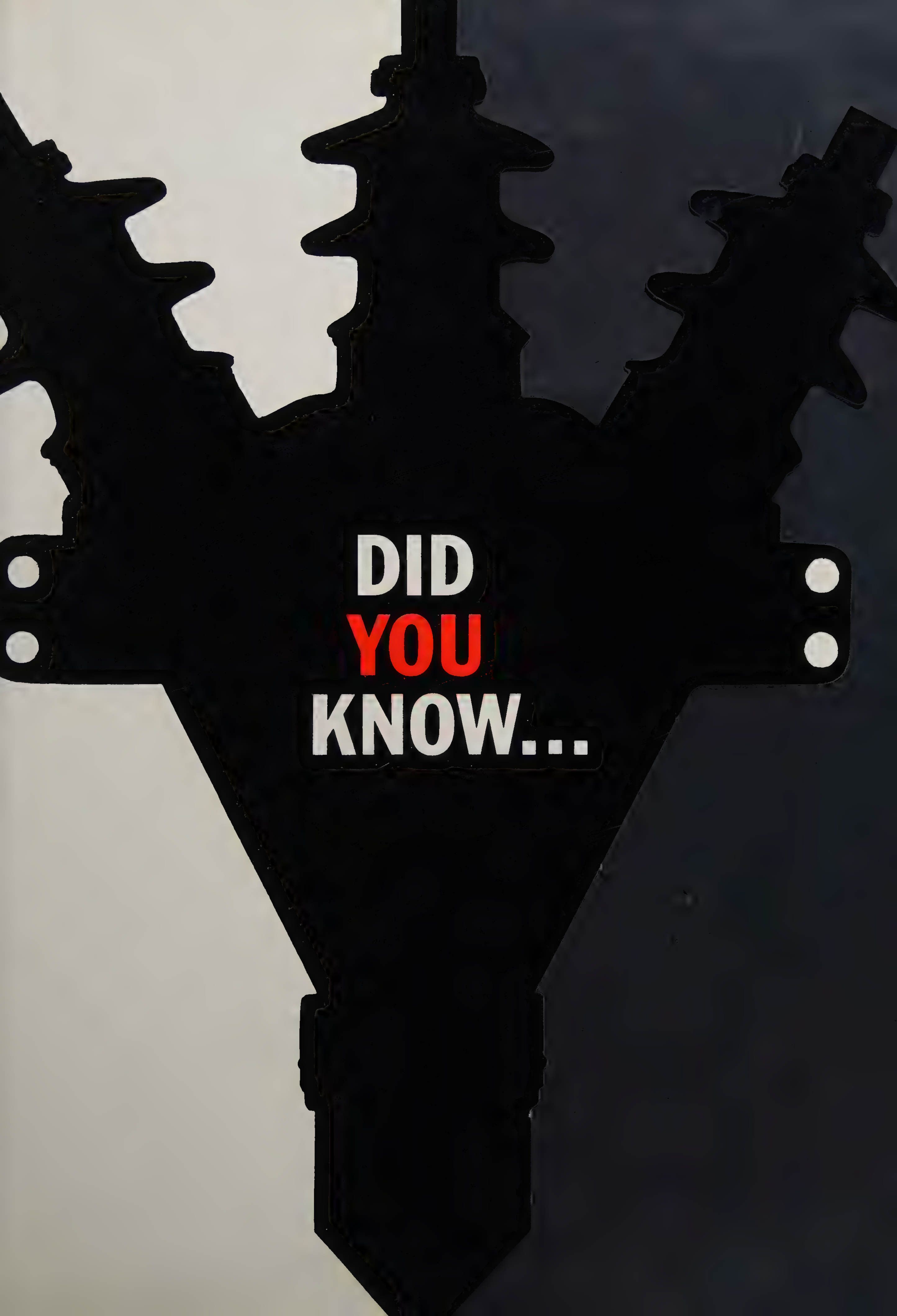
What about 1962?

So far a rather sharp initial upturn has taken place; this is probably typical of the early recovery stage after a shallow recession. This satisfactory statistical performance is now strengthened by favourable changes in major areas of government monetary, fiscal and exchange rate policy. Although it is not possible at this moment to tie these developments to actual numbers, we would expect the following broad trends in 1962:

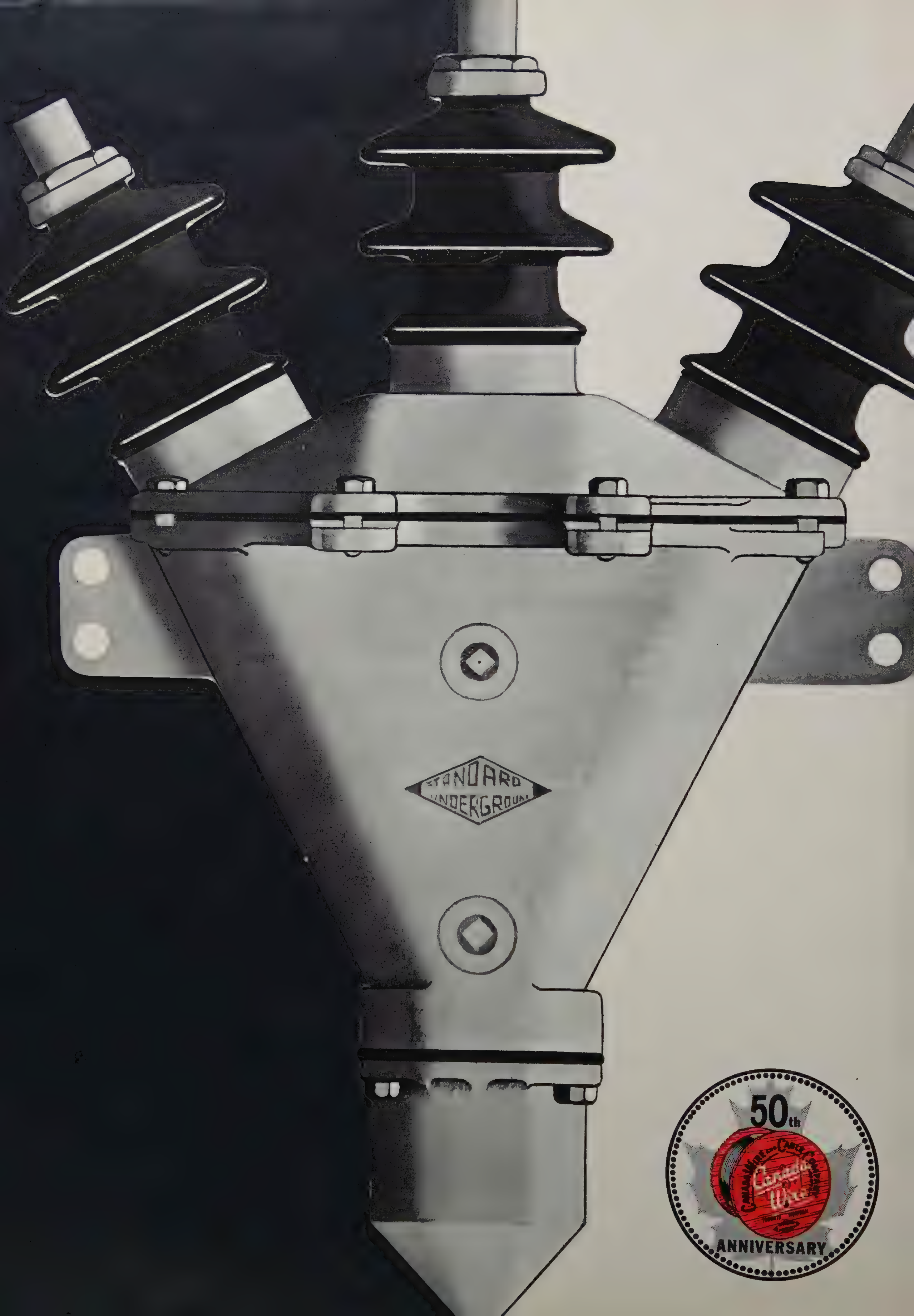
1. A large decrease in our current account deficit. This deficit amounted to $1.2 billion in 1961 (on a national accounts basis), but had already been reduced to a $1 billion average in the first half of 1961 ($800 million in the second quarter.) At present, expansion in the volume of Canadian exports to the United States is indicated as the result of the strong business upswing there, while the lower exchange rate on the Canadian dollar will mean:
   (a) higher payments received for goods sold in foreign currency,
   (b) a better competitive position for products now sold in Canadian dollars, and
   (c) new market possibilities.
   On the import side there will be two forces pulling in different directions: the immediate higher price (in Canadian dollars) of all products sold in foreign currency, and short-run import substitution opportunities. This should mean a rather sharp rise in exports, a less pronounced rise in imports and an increase in our invisible payments during 1962, and we may look forward to a sizeable reduction in our current account deficit during 1962.
2. Business gross investment is another key sector for 1962. Since 1957 there has been a steady decline in business investment spending, from a peak of $7,335 million to $6,612 million last year. By the second quarter of 1961, business investment had shown further disappointing declines, reaching an annual rate of $6,128 million. On the basis of the first survey of business investment spending intentions for 1961, few changes in total private investment spending between 1960 and 1961 should have been expected, and the mid-year review of these intentions showed a very small increase in intentions. It is difficult to believe that in the face of a business upswing, a downward revision of earlier business investment spending plans is taking place. Furthermore, it is hard to project 1962 as a satisfactory year without at least some definite comeback above the $6.5 to $6.6 billion business investment spending level which is indicated for 1961 on the basis of exisiting intentions. Yet this implies an interesting conclusion: to achieve even a $6.5 billion spending level for 1961, a second-half rate of more than $6.7 billion is involved.
3. Consumer spending increased by 1.4% in the second quarter; this came after a small decline in the first quarter. In estimating consumer spending for 1962, a continuing serious rate of unemployment, and a low rate of new family formation should be taken into account. Total consumer expenditures in 1962 should be about 5 to 6% higher than in 1961; a projection of this magnitude excludes a "consumer boom" and real per capita spending.
4. Government spending for goods and services is probably easiest to forecast with probable gains in the range of 6%.
5. Inventories must be divided into two major components. Barring another crop failure, farm inventories should play an approximately neutral role, particularly if wheat sales continue at their present high level as a result of extraordinary non-commercial deals. Non-farm business inventories (which behaved peculiarly during the 1960/61 recession because their entire liquidation was crowded into the third quarter of 1960) will probably be built up at a modest rate, lending some support to overall business activity.

Conclusions: 1962 — good, but not spectacular

Thus we are looking for a good year in 1962, though the advance will hardly be spectacular. In terms of our major problems — unemployment and the current deficit in the balance of international payments — some improvement is indicated, though by no means their sudden elimination. Major elements in public policy are working in more desirable short-term directions. The balance of 1961 and 1962 will test their effectiveness, and the proposition that somewhat smoother sailing now lies ahead for the Canadian econmy. At least at this stage we are cautiously optimistic that business expansion will be sustained in 1962.



DID YOU KNOW...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...THAT THE LARGEST conductor potheads currently in service in Canada—4,250,000 circular mils copper area—were designed and manufactured by Canada Wire?

...THAT THE HIGHEST voltage rating potheads currently in service in Canada—330,000 volts—were designed and manufactured by Canada Wire?

...THAT CANADA WIRE AND CABLE COMPANY LIMITED is the *only* company in North America which designs and manufactures complete underground cable systems? This includes installation of potheads and all other accessories in the high-voltage ranges—69,000 to 330,000 volts. Canada Wire is thus particularly well qualified to assure proven design and highest quality . . . and co-ordinated manufacture means early and coordinated deliveries. Canada Wire underground cable systems are in operation in Pakistan, U.S.A., Spain, Mexico, Bermuda, Venezuela, Colombia, Argentina, Chile, Cuba, Brazil, Peru and other countries. Specify and benefit from Cables and Potheads from *one* manufacturer—Canada Wire.

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SIXTY YEARS AGO

Excerpts from the November 1901 issue of Electrical News & Engineering

This rather incredible account was tucked into a corner of a back-of-the-book page:—

A demonstration of the efficiency of the electric fire-proofing process as applied by the Electric Fire-Proofing Company of Canada was witnessed on the Champ de Mars, Montreal. A house built entirely of wood treated by this process was tested by placing inside thereof a large amount of kindling and fire wood saturated with kerosene, which was then set on fire. The structure could not be made to burn and the experiment proved most successful. At the conclusion of the test the Mayor congratulated the company and stated that he hoped to see the day when wood proofed by the electrical process would be used in all constructions in Montreal.

We are curious to know the secret of this process. If any of our readers knows something about electric fire-proofing of wood, we certainly would appreciate hearing from them.

* * *

On the Questions and Answers page, "Ambition" asked: Would you please describe the construction of an electric radiator or heater?—

ANS.—Any and all substances carrying electric currents have their temperatures raised when the current is flowing, and thus give off heat to the medium surrounding them.

The heat which in practice is obtainable from a given amount of energy is limited by the temperature which the conductor will stand before oxidizing, and in order to raise this temperature to the highest point, some manufacturers use wire whose composition is more or less a secret, being made from some of the rarer metals, mounting the spirals in an non-combustible and insulating frame, usually of iron and porcelain; other wires are made almost entirely of iron and imbedded in sand or cement, which has the effect of keeping the air away and thus allowing the heat to be greater than if the conductor were in the open air, in which case it would burn at a much lower temperature.

It is not practicable for any but those commercially engaged in their manufacture to make a heater which shall be reasonably efficient, but if efficiency does not appreciably affect the case, a very serviceable article can be made from ordinary galvanized iron wire, the necessary size and length, in the absence of any information as to size of room you desire to warm, being a matter of experiment.

If for alternating current, care should be taken to wind it as much as possible non-inductively, and to thoroughly secure all the parts, or else the humming will be very loud and disagreeable.

* * *

"Book Reviewing by the Boiler Inspector" was the heading over this item, which was pirated from a magazine called "The Locomotive":—

We have received from the publishers a copy of 'An Englishwoman's Love Letters,' with a request that we give it a review in The Locomotive. We have no regular love-letter editor on our staff, and we therefore turned it over, first, to our expert on riveted joints, who is reputed to have had some experience in such matters. He says that the writer of the letters is badly designed; that she has a poor circulation, and a cracked head, and that a few bricks are loose in her setting; and he swears he will take no responsibility for her, until she has been submitted to a hydrostatic test of at least a thousand pounds. His judgment has always been good on matters more directly in his line, but we were so sure that it was in error in this particular case that we took the book away from him and made a complete internal inspection of it ourselves.

We quickly found that the language is so warm that our expert on combustion was the proper man to consult. He was on his vacation, however, and we didn't want to call him back to make a calorimeter test during this hot weather. Our chemist shook his head sadly when we offered the job to him, and the only available man left on our staff was the automobile editor, who takes the place of the horse editor, that we discharged when the horse went out of fashion. He says the author has wheels all right. He doesn't wish to condemn the book, though, for he says that while it isn't in his line, he should judge that it would be hot stuff in somebody else's line.

* * *

Another non-electrical item described a primitive marine propulsion system:—

Capt. Thomas Bixby, under whom Samuel M. Clemens (Mark Twain) served as pilot and "engineer" on the old Mississippi River boat Swallow, has given the following description of the engine of the Swallow: "The Swallow had the queerest sort of engine that was ever seen. The craft itself was a little shaky—it only plied between St. Louis and Cairo—being about thirty feet long, with a stern wheel, a place for freight and passengers, a pilot-house, and a place on what may be called the pilot-deck for the engine. That engine went aboard when it was needed, and only then. It burned no wood nor coal, but ate a powerful sight of grass.

"It was a large gray mule named Jerry, which worked a treadmill that propelled the boat. Sam Clemens—you know his name of Mark Twain came later—was chief engineer and pilot. He had a system of signals and they were ingenious. By pulling a cord he could raise a head of cabbage just out of the reach of the mule. The engine would start for it, and begin to walk after it, and the boat floated majestically on down the river or up, as the case might be. When Sam wanted to stop he would pull a rope attached to the feed box of the engine.

"Without intending to be personal, I will say that Jerry was one of the most intelligent animals I ever met. His voice was more on the order of a fog horn than a whistle—it was too much of a baritone for the latter. When Sam wanted to whistle for a landing he hit Jerry with a stick. If he wanted, in the profane language of the river pilot, to go ahead like the ———, he gave Jerry a touch of the whip."

* * *

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...from Canada's forests, mines and factories come raw materials, component parts and complete assemblies which go into the numerous products of Northern Electric. This Northern Electric policy to support Canadian industry is an ever-growing one. Northern Electric designs, manufactures and installs a large proportion of Canada's telephone communication systems and equipment. It includes the manufacture of electrical wires and cables for communications and power transmission, and the distribution of a complete line of electrical apparatus and supplies. At Northern Electric, product research and development never stop and continuing progress is made in the communication, electrical wire and cable fields.

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FOCUS ON PEOPLE

● H. G. McHaffie, president of Associated Electrical Industries (Canada) Ltd., announces the election of **James A. MacLean** as a director of the company.

When Metropolitan-Vickers opened an office in Canada he was appointed manager, and on the integration of the subsidiary companies of Associated Electrical Industries Limited in 1959 he was appointed manager, central district. He is a Professional Engineer, Member E.I.C., Associate Member A.I.E.E. and Associate Member British Institute of Management.

● W. E. Thurman of Thurman Supply Company, Regina, announces the appointment of **Charles F. Clare** as sales manager. Mr. Clare was born in Prince Albert, Sask., and following overseas service with the Canadian Army has been engaged in the sale of electric machinery and power apparatus in the prairie provinces.

● **Lloyd W. Pyke** has been appointed general sales manager of Harvey Hubbell of Canada Limited. He was previously manager of the Hubbell Division of the Crouse-Hinds Company.

● **Richard Noonan,** president of the Pioneer Electric Group of Companies, Winnipeg, has been elected to the Board of Directors of Federal Pacific Electric Company, Newark, New Jersey. The announcement was made by F. H. Roby, executive vice-president of Federal Pacific. This is another step in the integration of Federal Pacific Electric Company and the Pioneer Electric Group.

● The appointment of **J. G. Thibault.** P.Eng., as manager of the commercial department of Southern Canada Power Company Limited, and that of **T. Guy Troy,** P.Eng., as manager of the engineering department, have been announced by George L. Rattee, president and general manager of the company. Mr. Thibault was formerly manager of the engineering department and Mr. Troy, assistant manager of that department. Both are members of the Engineering Institute of Canada and the Corporation of Professional Engineers of Quebec.

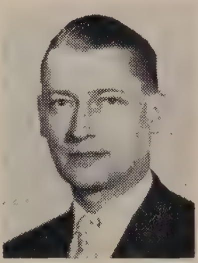
J. A. MacLean

M. T. Ferguson

C. F. Clare

Dr. Tupper

D. J. Tamblyn


E. A. Chandler

L. W. Pyke

H. J. Houston

R. Noonan

D. O. Kitching

J. G. Thibault

T. G. Troy

● **Arthur G. Bamford,** owner of Sutherland-Schultz Electric Co., Ltd., Kitchener, Ontario, has been appointed chairman of the Canadian Affairs Committee of the Electrical Apparatus Service Association, it has been announced by George Larsen, of Los Angeles, California, international president.

The Electrical Apparatus Service Association is an international trade organization of more than 1,500 electric motor, generator and transformer service and sales companies in North America. It was founded in 1933 as the National Industrial Service Association. National headquarters are in St. Louis, Missouri.

● A. B. Maden, general sales manager of Pirelli Cables, Conduits Ltd., announces that **M. T. Ferguson** has been retained by the company. Mr. Ferguson recently retired from the Canadian International Paper Company and has forty years of experience in the pulp and paper industry. He was electrical superintendent in Three Rivers.

● **Dr. Kenneth F. Tupper,** formerly Dean of the Faculty of Applied Science and Engineering at the University of Toronto, and past president of the Engineering Institute of Canada, is now president and director of Ewbank, Tupper & Associates, formerly Ewbank and Partners (Canada) Limited.

● President and general manager of newly formed Dominion M.I. Ltd. (see News of the Industry) is **E. A. Chandler. D. J. Tamblyn** is general sales manager. Both were formerly with Bepco Ltd., now dissolved.

● President and general manager of N. Slater Company Limited, H. O. Jones, announces that **H. J. Houston,** P.Eng., has joined the engineering department as design engineer. Mr. Houston has spent six years in the electric utility industry.

● H. C. Ballantyne, general sales manager, Crouse-Hinds Company, announces the appointment of **D. O. Kitching** as wiring device sales manager. Mr. Kitching joined the company almost four years ago in field sales.

● Dr. Gordon Shrum, chairman of BC Electric, has announced the formation of a project office to assist in the co-ordination of all activities for the Peace River project. **R. M. Bibbs** has been appointed project manager with responsibility for administration of the project office and co-ordination of all aspects of the hydro-electric undertaking. Senior engineer, **Fred Spoke,** will have general responsibility for engineering and construction.

- **Thomas Chambers**, BC Electric's comptroller since 1948, has been appointed treasurer-comptroller of the company and manager of the financial division

- The appointment of **K. S. Barclay** as secretary-treasurer of Dominion Engineering Works Limited was announced by R. J. Barrett, president, following a recent meeting of the Board of Directors of the company. Mr. Barclay previously held the offices of secretary and assistant treasurer.

- **George C. Ember** has been appointed district manager, eastern Canadian area, for C & M products. He was formerly operations manager, apparatus department, Canadian General Electric.

K. S. Barclay

G. C. Ember

- **Grant E. Davidson**, supervising illumination engineer, Ontario Hydro-Electric Power Commission, Toronto, has been made a Fellow of the Illuminating Engineering Society.

- **H. J. McCaw**, electrical approvals superintendent, retired on July 31, 1961 in his 44th year with Ontario Hydro.

He was born in Hamilton in 1896. He joined Ontario Hydro in 1918 in the Meter and Relay section. In 1931 he transferred to the Approvals Department where he remained until 1937 when he organized the sales control section of the Electrical Inspection Department. During the years he was head of the section, he approved thousands of CSA reports in addition to approving hundreds of thousands of pieces of equipment of every type and description.

In 1951 he was chairman of the Ontario Chapter of the International Association of Electrical Inspectors. Mr. McCaw has had eye trouble in recent years as a result of an inspection accident and has been on sick leave for some time. When his eyesight improves he intends to enter the electrical consulting field.

Prof. Tracy

J. M. Hambley

- The Directors of the American Institute of Electrical Engineers have elected two Canadian engineers to the grade of Fellow: **Professor Gordon F. Tracy**, head of the department of electrical engineering at the University of Toronto; and **J. Mervyn Hambley**, general manager of Ontario Hydro.

- J. W. Kerr, president, Triangle Conduit & Cable (Canada) Limited, announces the election of two new members to the Board of Directors, **Norman L. Mathews**, Q.C., and **Joseph Thompson**.

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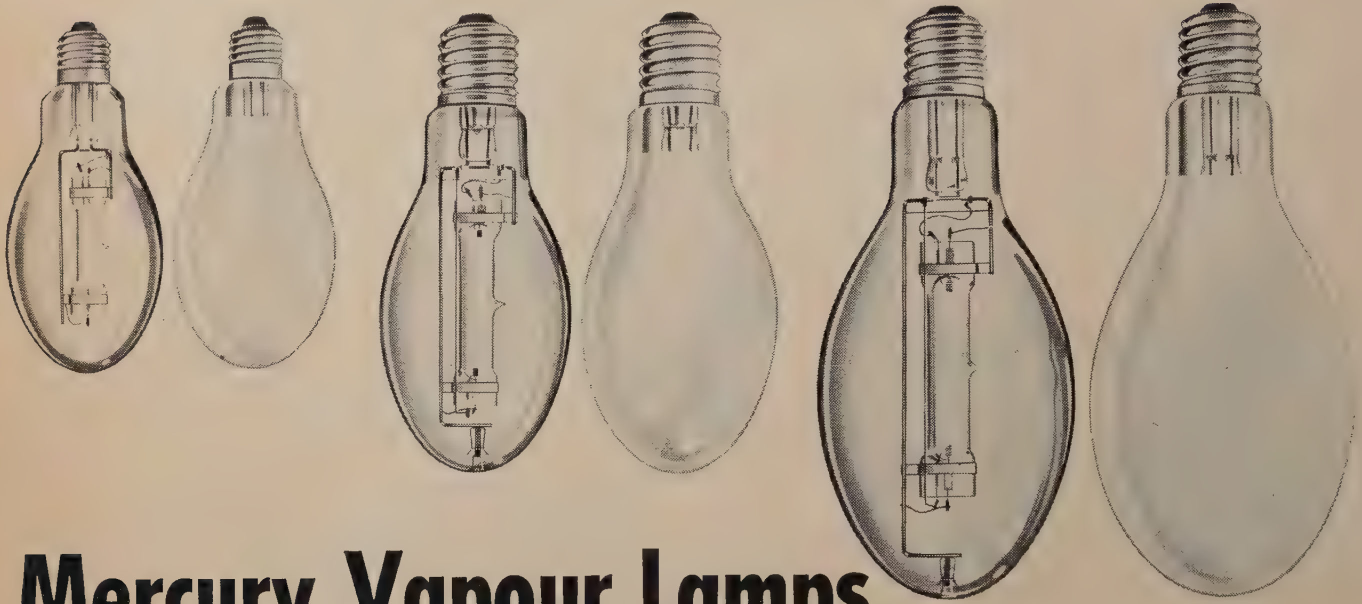

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WHAT DOES THIS MEAN TO YOU? It means greater serviceability and effectiveness for your lighting dollar—plus—longer life for reduced operating costs through fewer replacements. Whatever your lighting requirement, your best bet is Philips—largest manufacturers of Mercury-Vapour lamps in the world.

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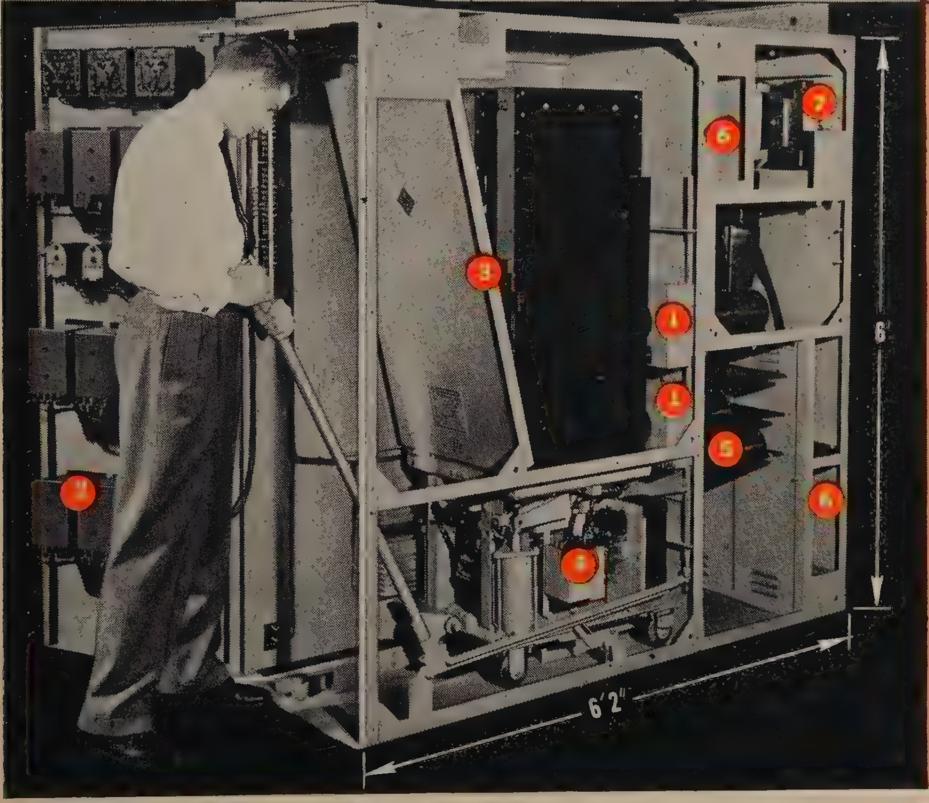
CANADIAN ALLIS-CHALMERS



▲ 4.16 kv metal-clad equipment serving a western city.

1. Separate compartments for current transformers.
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3. Double-lock panel for operator safety.
4. Easy service accessibility without dismantling.
5. Glass polyester insulation throughout.
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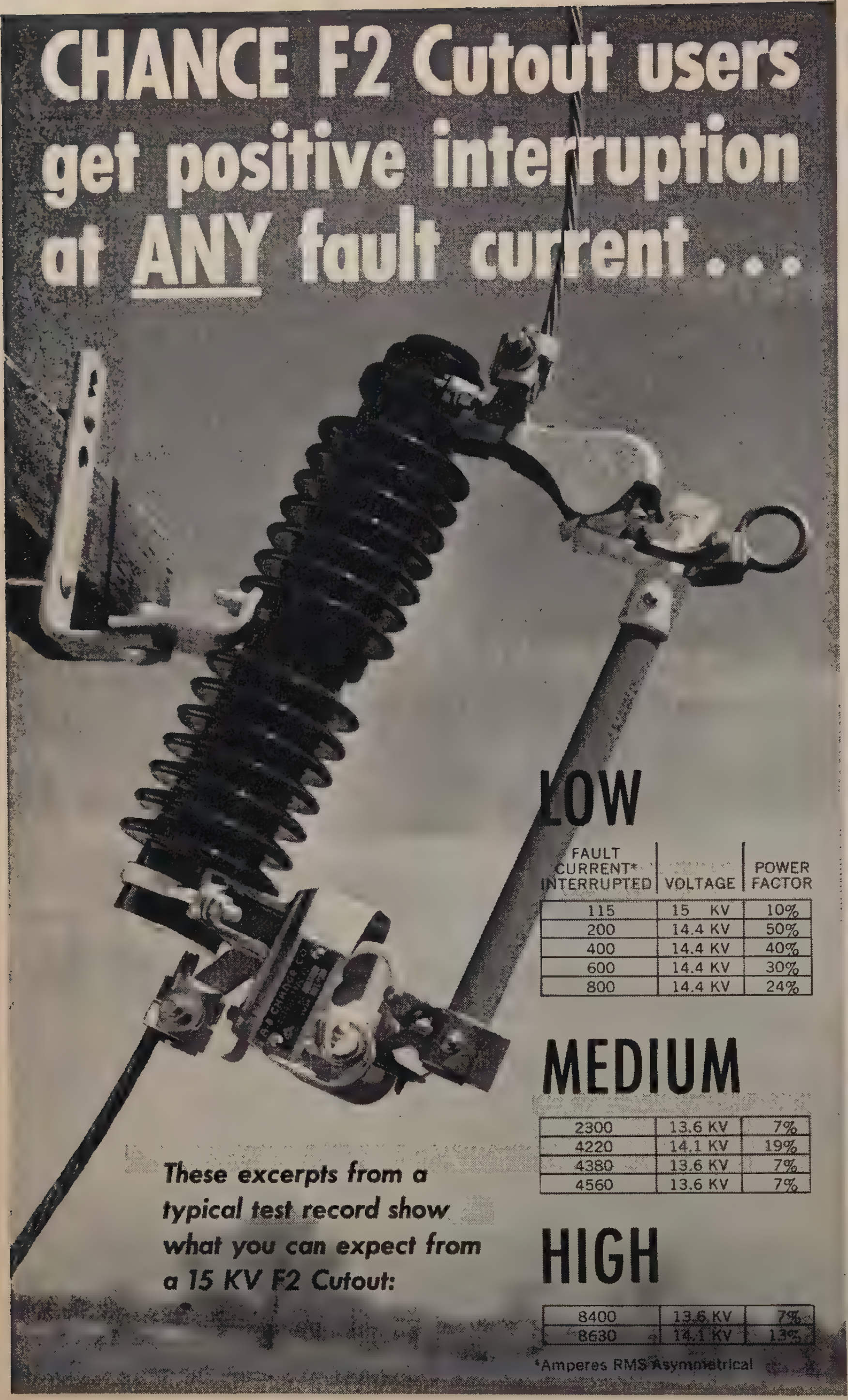
7. Fully cast, trunnion-mounted potential transformers.

Lowest height, easiest access

the only switchgear with fully isolated current transformers

The front-accessible current transformers can be inspected, maintained or replaced without exposure to any high voltage compartment. A-C metal-clad units are just 72 inches high — means eye-level instrumentation . . . shoulder-height accessibility of component parts. And the entire panel can be used for meters and relays. Maximum compartmentation and dead-front construction offer greater safety. Buswork and components arranged for easy addition of future units.

You get rapid, one-stroke insertion of the circuit breaker. The breaker has glass polyester insulation for highest impulse strength . . . the only self-locking protective barrier . . . four-bar linkage is mechanically, electrically trip-free. Primary disconnect fingers eliminate use of garter springs, and are on the circuit breaker for easy inspection. Both stored energy and solenoid operators are available. *For more information contact your nearest* **Canadian Allis-Chalmers** office. 61-SG-1



CHANCE F2 Cutout users get positive interruption at ANY fault current . . .

These excerpts from a typical test record show what you can expect from a 15 KV F2 Cutout:

LOW

FAULT CURRENT* INTERRUPTED	VOLTAGE	POWER FACTOR
115	15 KV	10%
200	14.4 KV	50%
400	14.4 KV	40%
600	14.4 KV	30%
800	14.4 KV	24%

MEDIUM

2300	13.6 KV	7%
4220	14.1 KV	19%
4380	13.6 KV	7%
4560	13.6 KV	7%

HIGH

8400	13.6 KV	7%
8630	14.1 KV	13%

*Amperes RMS Asymmetrical

Utilities from coast-to-coast, impressed with the ruggedness and full range effectiveness of the Chance F2 Cutout, have written it into their standards. These utilities are sold on the F2's ability to protect their systems from *any* fault—HIGH, MEDIUM, or LOW (and points between) without damaging shock to porcelain or fuse tubes. The F2 expendable cap and link ejector make this possible.

Chance F2 Cutouts, in voltages of 5.2, 7.8, 15 and 27 KV, and in 100 and 200 ampere ratings with interrupting capacities up to 12,000 amps, are available.

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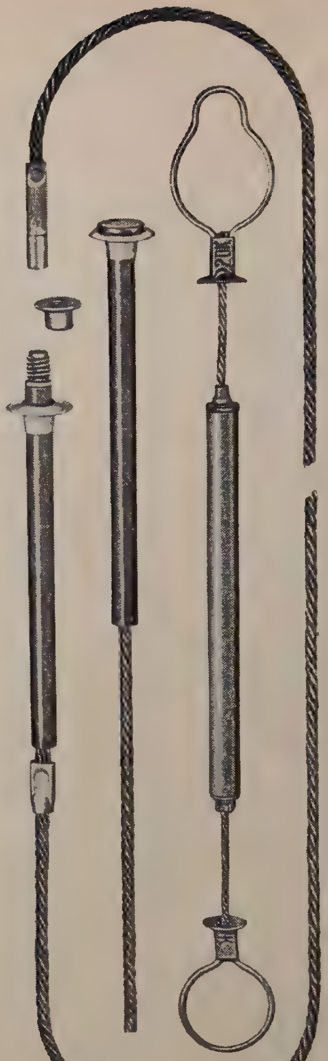

. . . and Chance Fuse Links perform dependably at all values of fault currents

Precision-made to EEI-NEMA Interchangeability Standards, Chance K (fast) or T (slow) links are available from 1 to 200 amps with Universal Buttonheads, or as Universals with removable buttonheads and cable adapters, and from 1 to 50 amps in Open-Link style. They have extra-high strength, two-ply protecting tubes with an arc-quenching inner layer and a weatherproof outer layer. Cables are lead-coated for maximum resistance to corrosion.

The fusible elements of these fast or slow fuse links have the consistent melting characteristics needed to give dependable performance in any distribution cutout at all values of fault currents.

Chance Fuse Links are packaged in 5-unit, easily separated containers. Perforated ends on each container allow easy removal of link, even with gloved hands. Type and rating are clearly marked on both ends of each box.

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6102 R

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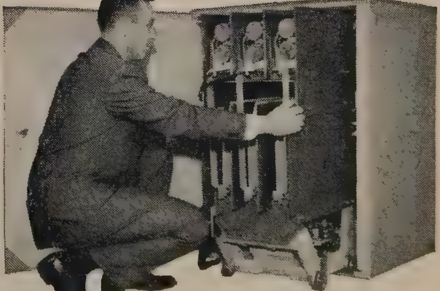
Inspection and maintenance are greatly simplified. One man can easily roll the carriage from the control enclosure for complete accessibility. Arc chutes and barriers lift out and the pole pieces rotate to expose the contact structure.

And, *SpaceMaker* control is completely safe. It is impossible to come in contact with "live" parts because the contactor is connected and disconnected with the door closed and live line connections are isolated by automatic shutters.

For complete details of the new, years-ahead SpaceMaker *controller, call your nearby A-C distributor or representative. Or write* **Canadian Allis-Chalmers,** *P.O. Box 37, Montreal, Que.* 61MC-1



SpaceMaker is an Allis-Chalmers trademark.

GROWING

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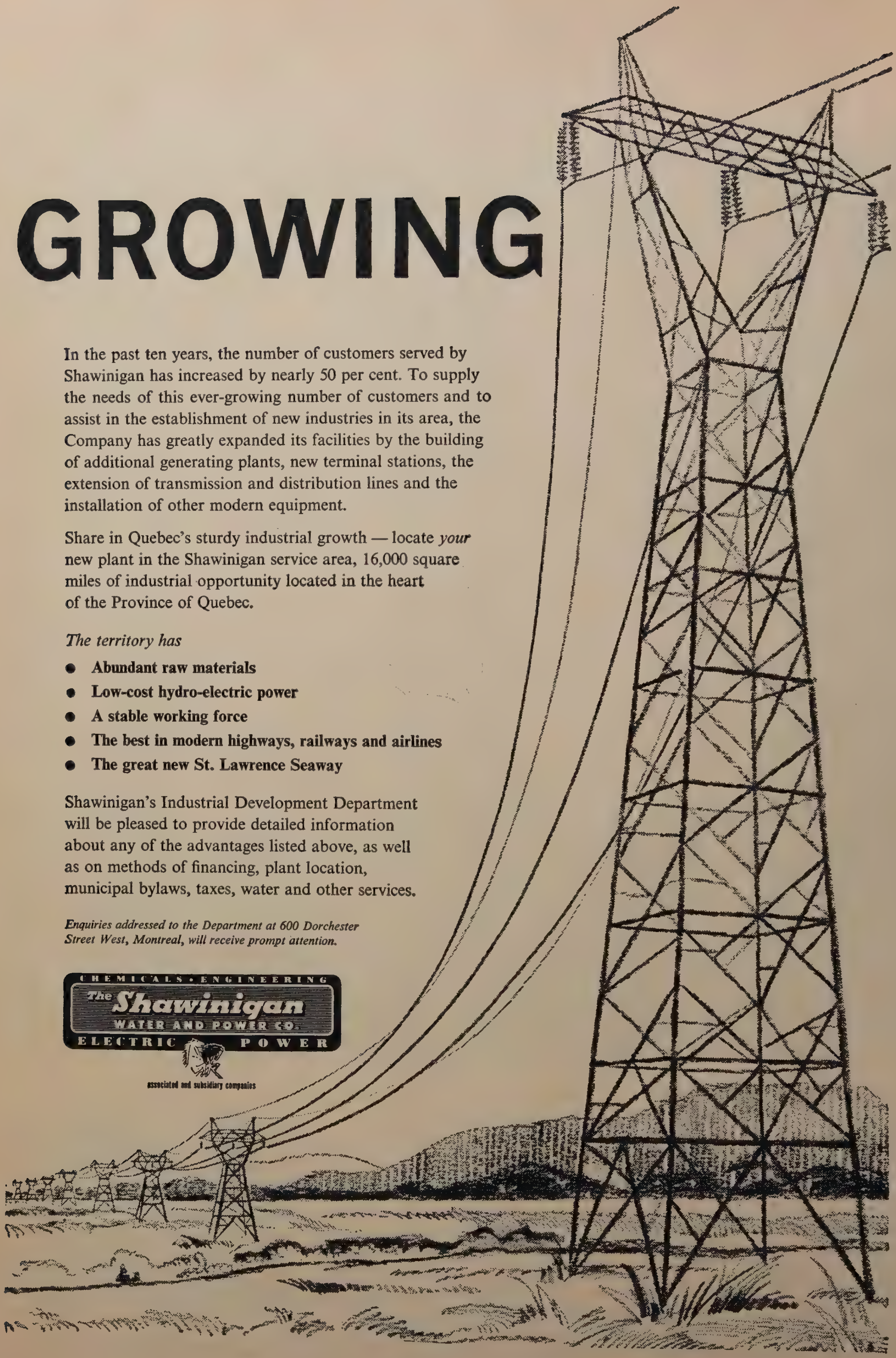

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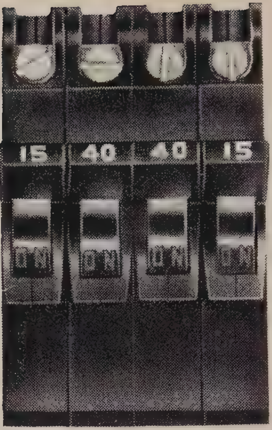

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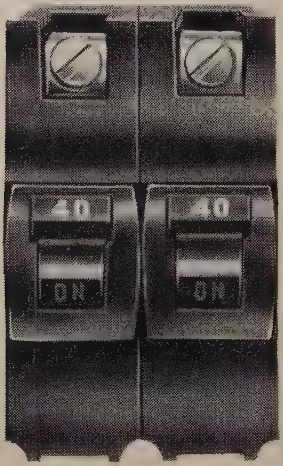

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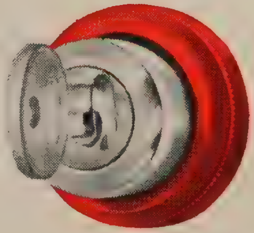
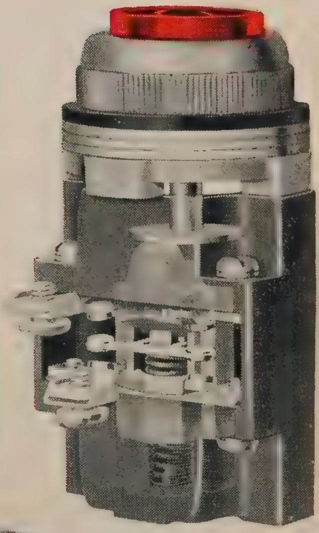
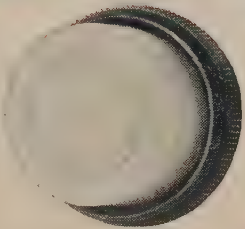
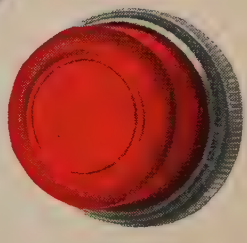




Phantom view of push button control unit with button partially depressed to show internal construction





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GS planners await operation of 20-Mw nuclear plant with bated breath

7000 Mw of nuclear capacity could be added to Ontario system by 1980

By **H. A. SMITH***

Some 21,000 Mw of generating capacity will be required by Ontario Hydro's main system by 1980. The present amount is about 6000 Mw.

Since it is probable that only 2,000 or 3,000 Mw of additional hydro-electrical capacity can be developed economically, there will be a requirement for roughly 12,000 Mw of some type of thermal plant capacity over the next twenty years. About 60% of this will be required to operate at relatively high capacity factor.

There are two principal objections to coal-fired thermal plant. First, it means an increase in the cost of supplying electric energy in the province. Secondly, since it appears that the most economical fuel for thermal plants in southern Ontario will continue to be coal, the bulk of which will likely continue to be imported from the United States, Ontario Hydro will be forced to rely more and more on a foreign source of fuel.

These objections, coupled with the fact that there are major uranium resources within the province as well as facilities for manufacture of reactor fuel, naturally combine to create a serious interest in the development of nuclear power plants suitable for application in this system.

Economic considerations

In assessing the suitability of a plant for any system, the cost target is of prime importance. Typical estimated capital costs of plant now under construction in the system are:

Coal-fired thermal plant—$128 per kw installed.
Hydro-electric plant —180 Mw, 0.5 a.c.f. (assumed capacity factor), 107 ft. head—$230 per kw installed.
Hydro-electric plant (on same site) —90 Mw, 0.8 a.c.f.—$363 per kw installed.

Unit energy costs corresponding to the above capital costs are:

	MILLS/KWH			
	Fixed	Op. and Mtce.	Fuel or Water Rental	Total
Thermal Plant 0.8 c.f.	1.3	0.5	3.3	5.1
Hydraulic Plant 0.5 c.f.	2.7	0.2	0.2	3.1
Hydraulic plant 0.8 c.f.	2.6	0.2	0.2	3.0

The unit energy costs shown above apply at the high-voltage bus and are based on a long-term average interest rate of 4½%. This gives a composite rate for interest plus depreciation of 4.85% for hydro-electric plants (60-year composite life) and 5.9% for conventional coal-fired thermal plants (33-year composite life). The corresponding figure for a nuclear plant having a 28-year composite life would be 6.35%.

Conditions for competitive nuclear power

From the foregoing, it will be evident that the target for competition for the nuclear plant is established at present by the cost, reliability and safety characteristics of a conventional coal-fired plant of large capacity. Thus, the following requirements and conditions for a plant to be suitable in the reference system may be inferred:

1—It must produce energy at a cost not greater than 5.1 mills per kwh on a 0.8 capacity factor basis, this figure to include any differential transmission cost due to any need for locating the nuclear plant remote from load centers.

2—Because of the nature of nuclear plants, it is likely that base load operation must be assumed to achieve competition with conventional coal-fired plant. If so, the plant must possess characteristics which will tend to ensure that the assumed capacity factor will be achieved on *a life-time basis*, viz.: (a) It must be reliable so that it has high availability. (b) It must be durable or have readily replaceable components. (c) It must have low operating, maintenance and fuelling costs so as not to be forced into gradually reducing capacity factor operation throughout its life by the advent of more economic plant.

3—The electrical capacity per reactor should not exceed 300 Mw up to 1965.

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*Mr. Smith is Manager, Nuclear Power Plant Division, Atomic Energy of Canada Ltd., and Assistant General Manager, Engineering, Ontario Hydro. Pages 67-70 contain major extracts from papers presented at the 7th AECL Symposium on Atomic Power.

4—It should use fuel available in Ontario and should not require facilities for reprocessing spent fuel. There is at present no satisfactory basis for planning the sale or reuse of materials recovered from a reprocessing operation.

5—It should have a forced outage rate not greater than that of a modern conventional plant.

An analysis of forecast load demands and resources now committed indicates that, unless a nuclear plant can offer a unit energy cost less than the target mentioned previously, an output of 1,400,000 Mwh (representing a 200-Mw plant at a 0.8 capacity factor) could not be absorbed economically by the system prior to 1965.

Available types of nuclear plants

In the sense that there are prototypes operating and large commercial stations in advanced stages of construction, there are only two basic types of nuclear power plants available at present for application in the Ontario Hydro system. These are the stations employing the graphite-moderated gas-cooled and those employing the light-water moderated and cooled reactors.

Graphite Reactors—In many respects the graphite-moderated gas-cooled nuclear plant meets the requirements for Ontario. It utilizes natural uranium fuel in a form which could undoubtedly be manufactured locally. The Calder Hall type of dual-purpose plant, after which the single-purpose power plants are patterned, has demonstrated high availability and the estimated fuelling and operating cost is relatively low.

However, this type of plant requires a large proportion of on-site labour and it has been estimated that, even with the most advanced designs, the capital cost of such a plant constructed in Canada would exceed $450 per kw. Taking the currently assumed life of 20 years and a 0.8 capacity factor, the unit energy cost from such a plant in the Ontario Hydro's system could hardly be expected to fall below 6.6 mills per kwh even with very favourable assumptions. This estimate includes only 1 mill per kwh for fuelling cost, implying the use of spent fuel reprocessing facilities.

Furthermore, although it is generally believed that the graphite-moderated type of plant is highly developed and therefore offers little risk to the prospective owner, the fact is that statistical information on long term fuel irradiations is very limited and there is still considerable doubt as to the effective life of graphite in the core.

Thus, there is little evidence to support the choice of this type of nuclear plant for the Ontario application.

Light Water Reactors—U.S.A.E.C. studies of advanced types of pressurized and boiling light-water moderated types of reactors predict unit capital costs in the range of $250 to $300 per kw and fuelling costs in the range of 2.7 to 3.1 mills per kwh. Applying these estimates on the basis of a thirty-year life and a 0.8 capacity factor in the Ontario Hydro system gives unit energy costs in the range of 5.4 to 6.1 mills per kwh. Operating experience on full-scale plants of both types is available. Therefore, it might be considered that one of these types would have a reasonable probability of meeting the Ontario requirement.

However, on two counts at least, the light water moderated reactors fail to comply with the requirements mentioned previously. In the first place they require enriched fuel not now produced in Canada. In the second place, the fuel program to achieve costs of 2.7 to 3.1 mills per kwh requires reprocessing of spent fuel. If Ontario Hydro is going to import enriched fuel, or utilize foreign reprocessing facilities, it may as well import coal from the same source and avoid the development problems associated with nuclear plants.

A further point in connection with this type of plant is the doubtful assumption that nuclear plants fuelling at about the same unit cost as a conventional coal-fired plant can, in practice, ever attain a life-time capacity factor of 0.8.

Thus, the light-water-moderated types of reactors cannot be said to fit the requirements in Ontario any better than the graphite-moderated type.

The Heavy-Water-Moderated and Cooled Plant—Although the natural uranium heavy-water-moderated and cooled reactor under development in Canada must be viewed as being in a less advanced stage of development than the types mentioned previously, since no such type is operating, nevertheless this type of plant offers attractive possibilities in meeting our requirements in Ontario and these possibilities are supported by quite extensive research, development, design and construction information. Some of the advantages are:

1—Using an interest rate of 4½%, a composite life of 28 years and an annual capacity factor of 0.8, the estimated unit energy cost from the first 200-Mw unit is about 6 mills per kwh and, for the same plant with a duplicate unit installed, the estimated cost approaches a 5.1 mill per kwh target. It should be noted that the composite life of 28 years assumes a reactor life of 15 years, the design being such that this unit is physically replaceable. The fuelling cost included in both estimates is 1.1 mills per kwh and operating and maintenance amounts to approximately 1 mill per kwh.

2—The low fuelling cost is attained by virtue of the high burn-up capability of this type of reactor rather than by proposed spent fuel reprocessing facilities.

3—The low fuelling cost is more compatible with the assumption of 0.8 lifetime capacity factor than in the case of the U.S. type of plant.

4—Fuel is natural uranium manufactured locally.

CANDU-type reactor is proving best

The natural uranium heavy-water-moderated reactor, insofar as can be established prior to actual operating experience with a full-scale plant, appears to offer the best chance of meeting the requirements considered important by Ontario Hydro. Although this view is based on a very substantial amount of

(Continued on page 70)

After CANDU – fog-cooled reactors?

Ordinary wet steam replaces heavy water as coolant in an unusual reactor proposal now being evaluated by AECL. Energy costs look promising

by G. A. Pon*

The fog-cooled heavy water moderated reactor is an advanced system presently being studied at Chalk River. It differs from CANDU in that the pressurized heavy water coolant is replaced by wet light water steam. The wet steam or fog is dried and taken directly to the turbine.

Advantages

The main advantages of fog as a reactor coolant are:—

(1) The density is much lower than that of liquid water; hence it is feasible to use H_2O fog in a natural uranium D_2O moderated system.

(2) The heat transfer coefficients are very high — of approximately the same order of magnitude as for liquid metals.

(3) The heat transport properties are excellent, as this is an evaporative process. There is essentially no temperature difference across the reactor. For CANDU a coolant flow rate of 1 lb/hr transports approximately 100 Btu/hr of power from the reactor core. For a typical fog design the same coolant flow rate transports approximately 250 Btu/hr from the reactor.

(4) The steam can be taken directly to the turbine after suitable separation of water. This leads to high efficiencies and the elimination of the heat exchangers.

(5) As far as reactor physics is concerned the coolant behaves as a homogeneous medium. This is in contrast to the boiling water reactor in which the coolant is in two distinct phases. Therefore, the fog reactor may not have the same nuclear stability problems as the boiling system.

(6) The fog concept is a logical development of the water cooled systems in which there is considerable experience. *It is probable that no new materials need be developed for a competitive fog reactor.* The zircaloy developed for the water systems appears to be adequate, although this must still be confirmed with in-reactor tests. *No large program on coolant technology is required.* It appears that *much of the fuel development on zircaloy clad UO_2 is applicable.*

The CISE group in Milan, Italy has been engaged in fundamental studies of fog cooling since 1957. It is at present the leader in this field. At Chalk River we have been studying fog cooling for about a year. We have just concluded an economic analysis and this is reported in NEI-163 by Pon and Marchetti. The purpose of that document was to establish that the concept was economically attractive. Much of the remainder of this article is taken from that report.

Economic study

A "hot" pressure tube system (similar to that of CANDU) has been chosen for the study. This con-

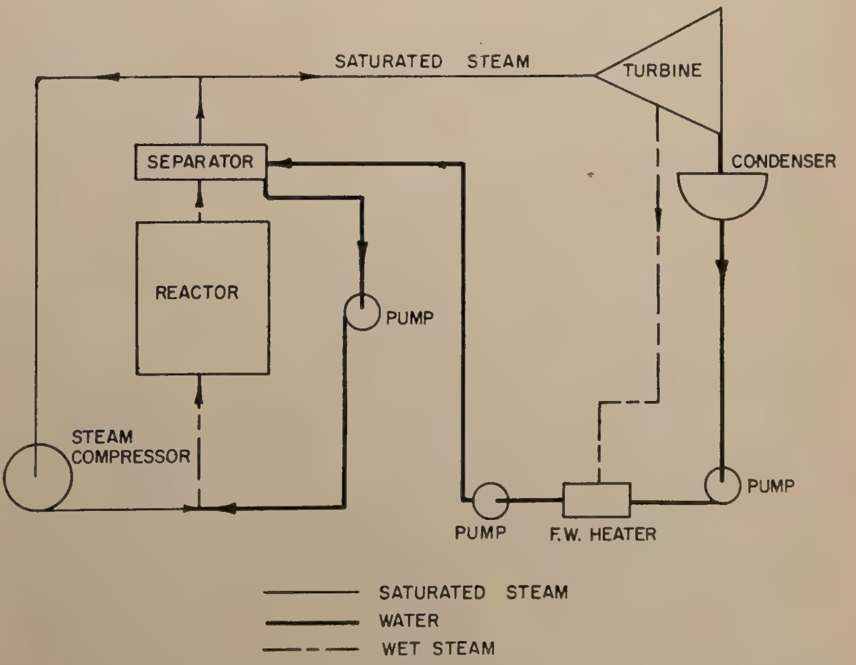

Fig. 1—Fog-cooled reactor power plant cycle uses no heat exchanger. Wet steam coolant is taken directly to turbine after moisture separation

sists of a Zircaloy-2 pressure tube which is surrounded by an insulating gas which, in turn, is surrounded by a Zircaloy-2 calandria tube. The pressure tube operates a few degrees hotter than the fog coolant while the calandria tube is at the moderator temperature (say 120°F). Only 19-rod bundles of solid cylindrical rods were considered. The fuel for all rods was natural uranium dioxide. The sheath was Zircaloy-2. All reactor cores studied produced 200 Mw (e). Radial reflection was provided by 60 cms. of D_2O. The coolant in all cases was light water fog.

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*Nuclear Engineering Branch, Atomic Energy of Canada Ltd.

A typical power plant cycle is shown schematically in Fig. 1. In this cycle the reactor produces wet steam which, after moisture separation, is taken directly to the turbine. This is in contrast to the CANDU system, in which steam is produced indirectly in a heat exchanger.

Let us now examine the flow diagram in detail. At the inlet to the reactor saturated steam mixes with saturated water. The total mass flow may contain about 15 to 25% steam. With the addition of heat in the reactor more steam is produced and at outlet the total mass flow may contain about 50 to 60% steam. The wet mixture then flows to a separator and the saturated water from this component is returned to the reactor inlet. The saturated steam takes two routes. Some of it is pumped back to the reactor inlet and the remainder is taken directly to the turbine. The feed water is returned to the separator where it mixes with saturated water and is then returned to the reactor inlet.

Cost comparison with CANDU

The data of Table I compare the costs of a reasonably attainable fog cooled reactor† and CANDU. A plug sign indicates a saving for the fog system.

TABLE I: Cost Comparison with CANDU

Partial Unit Energy Costs	+ .15 mills/kwh
D_2O in Primary Circuit	+ .15
D_2O Upgrading & Replacement	+ .1
Heat Exchangers	+ .1
Separators	— .02
Total Savings	0.5 mills/kwh

The partial unit energy costs, which are the costs associated with the reactor core, show a cost advantage of 0.15 mills/kwh in favour of fog. Most of this saving is due to a lower fuelling cost and a reduced amount of zircaloy in the pressure tubes. There is less zircaloy because the coolant pressure is lower with fog than with the liquid D_2O in CANDU. Also the total required length of channels is shorter. The lower fuelling cost results from a higher steam cycle efficiency. There is a saving of 0.15 mills/kwh in the primary circuit due to the replacement of D_2O with light water fog. The problem of heavy water leakage from the primary circuit no longer exists, and the saving for the fog reactor on this point is arbitrarily taken as 0.1 mills/kwh. The elimination of the heat exchanger saves 0.1 mills/kwh and the addition of a steam separator increases the cost by 0.02 mills/kwh. This gives a net saving of approximately 0.5 mills/kwh.

In this preliminary cost comparison no account has been taken of savings for the fog system due to:— (1) Lower pressure in primary circuit (800 instead of 1300 psia). The pressure tube was properly assessed but the cost of end fittings and the piping system was taken equal to that of CANDU. (2) The elimination of D_2O from the primary circuit. Many precautions have been taken in the CANDU design to limit and collect the leakage of heavy water. The extra cost of these precautions is difficult to determine and has not been included in the comparison.

In addition, no account has been taken of cost increases for the fog system due to the possible requirement for stainless steel piping valves, and the possible need for a more complicated turbine system to handle active steam.

Potential for future development

A natural development of the fog concept is to take the saturated steam from the separator and return it to the reactor for superheating. Some channels of the reactor would then be cooled by fog and the remainder by superheated steam. By these means improved efficiencies can be obtained.

The economic study has been sufficiently encouraging to warrant an increased effort on the fog-cooled reactor concept. Our immediate program can be described under three general areas: reactor feasibility study, in-pile testing, and out-of-pile testing. The feasibility study is of a 300 Mw(e) reactor station. We expect to present a preliminary design by June, 1962.

END

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†Reactor designed from a parametric study of over 100 possible reactors.

. . . bated breath

(*Continued from page 68*)

research, engineering and construction for such plants, final support or otherwise will only be obtained by operating experience.

Studies completed early in 1957 forecast that the second or third full-scale plant of this type to be constructed could reasonably be expected to compete on the basis of safety, reliability and economy with conventional thermal plants for base load applications in Ontario, and that such competition could be achieved by approximately 1967. On the basis of these studies, Ontario Hydro undertook to participate with A.E.C.L. in the development of such a plant and to purchase it when demonstrated to be suitable for operation in its system.

Since that time, substantial work has been done which tends to confirm the 1957 forecast. However, operating experience with NPD-2* is still badly needed to substantiate assumptions concerning operating and maintenance costs and statistical performance of fuel. By early 1963 it is expected that there will be worthwhile practical experience to bring to bear on these questions.

END

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*The 20-Mw Nuclear Power Demonstration plant at Rolphton.

Our anti-combines laws work badly during hard times, says economist

Those administering the law should have wider discretionary powers

By Dr. D. E. ARMSTRONG
Director, School of Commerce
McGill University

Canada's electrical manufacturers are very concerned over the general lack of public understanding of their problems. The following address on combines was therefore heard with great interest and approval at the recent CEMA annual meeting.
—Editor

Our combines control legislation works reasonably well during periods of increasing demand. In periods of economic stagnation, such as we have at the present, it will not work unless accompanied by the utmost statesmanship and good sense on the part of companies, the Restrictive Trade Practices Commission, and the government.

When there are relatively few firms in an industry it is inevitable that they should set price only after they have taken into account the probable reaction of their competitors. The acceptance of this mutual interdependency leads inevitably to some explicit or implicit understanding among the firms about how prices will be determined. Our anti-combines legislation cannot hope to do more than make sure that agreements are implicit rather than explicit and that they therefore remain relatively fluid. In brief it is the objective of anti-combines legislation to prevent economic arteriosclerois.

Competition should be given free rein while demand grows

During prosperous times, I believe our legislation works reasonably well. When demand is growing, a businessman is unlikely to go after an additional bit of business unless he can obtain a price which will cover all the costs involved including those which are incurred in making additional plant and equipment available. With reasonably full utilization of capacity, therefore, price competition takes place around what might be called full costs. In the long run, the firms with the lowest costs (i.e. the most efficient firms) will be encouraged to expand, and the high-cost firms will contract. It is indeed the job of the combines investigation officers in this kind of environment to make sure that there is sufficient competition to squeeze out the high-cost firms.

However, in a period of stagnation the problem is quite different. If excess capacity is prevalent it will pay each businessman to go after each additional bit of business so long as it returns an amount of money which is somewhat above his out-of-pocket costs. If there is real atomistic competition in a period of excess demand, prices will inevitably fall to out-of-pocket costs.

It is customary for economists to read a stern lecture at this point to the businessmen who are going bankrupt and point out that this is nature's way of eliminating the weak and the infirm. It is

Professor Armstrong (centre) chats with four CEMA past-presidents: (l. to r.) T. J. Bell, Fiberglas of Canada; J. S. Keenan, Canadian General Electric; F. C. Wallace, Smith and Stone; O. W. Titus, Canada Wire and Cable

perhaps inconvenient to those being eliminated, but there it is.

No Darwinian selection during slump

I believe this attitude is so much nonsense. The firms that get eliminated by such a price war are not necessarily the most inefficient. They are more likely to be the small firms, the unlucky firms who happen to have large financial charges falling due during the period, the non-integrated, non-diversified firms who cannot draw on earnings form other lines of endeavour, and last but by no means least, the Canadian firms who must compete with international firms with much larger financial resources. The advantages to society of a price war have been greatly exaggerated. One thing is certain from our experience of the thirties. Where conditions favourable to price wars develop it is not long before our machinery for anti-combines control simply breaks down.

What do we do about this problem?

I am not too optimistic that we shall find any magic solution, but I hope that the application of statesmanship and good sense will make our difficulties manageable.

The greatest contribution which can be made to the solution of our anti-combines problem is the restoring of conditions of full employment of plant and equipment and manpower. This is obviously too complex a problem to deal with in a few minutes but let me bring to your attention the fact that the amount of research which has been done in this country about how to use the tools of monetary and fiscal policy to promote economic growth is negligible.

A good deal of statesmanship will be required on the part of the companies if we are to weather the current storm. Most implicit pricing arrangements are a variation of price leadership, and the price leader has great responsibilities. The price leader should be the firm with the lowest costs and the most economic sophistication. The reason that I stress economic sophistication is that the firm which possesses economic knowhow will reject the silly and short-sighted view that prices should be raised in response to a fall in demand. Firms that adopt such a policy are capitalizing on the short-run insensitivity of sales to increases in price. In the long run such a price policy is not in the best interests of the firm or the industry and makes the job of the government in maintaining full employment and price stability much more difficult.

Price leader should set price ruthlessly

The price leader should not, therefore, raise prices in response to falling or stationary demand even if capacity (and therefore capital costs) have increased. The price leader should also be quite ruthless in setting a price which puts pressure on the least efficient members of the industry. An industry which never sees a bankruptcy or a forced merger is not a healthy industry and might well be brought to the attention of the Restrictive Trades Practices Commission.*

Finally I come to the demands on the good sense of this Commission. I would suggest that our investigations of combines be implicitly (not explicitly) counter-cyclical. A period of stagnation is not, I suggest, the appropriate time to be upsetting existing pricing understandings. The time to upset pricing arrangements which are becoming excessively explicit is during a period of rising demand.

There is one exception to this rule: if during a period of falling demand and excess capacity an industry has nevertheless increased prices, then I believe the Restrictive Trades Practices Commission would be well advised to jump in with both feet.

Dissenting views were briefly stated by an official of the Department of Justice. One of Dr. Armstrong's suggestions referred to below was made in answer to a question, and was merely an extension of his main argument.

Mr. Quinlan is Deputy Director of Investigation and Research, Combines Investigation Act.

By J. J. QUINLAN

Doctor Armstrong's remarks appear to suggest some form of regulation by the Director or the Restrictive Trade Practices Commission. I might point out that this would likely raise a constitutional problem. Efforts at a regulatory type of control were made by the Board of Commerce Act of 1919 and the Dominion Trade and Industry Commission Act of 1935.

Both statutes, however, were held *ultra vires* of the Dominion Parliament on the grounds that they interfered with property and civil rights in the provinces and were not incidental to federal powers in relation to criminal law or the regulation of trade and commerce. It may be of interest to note that in the latter statute, provision was made for approval of agreements by the Governor in Council on recommendation of the Dominion Trade and Industry Commission if satisfied that such agreements were not against the public interest.

In regard to the suggestion that the Director should not institute investigations involving industries which were operating under adverse economic conditions either in the industry itself or generally, it should be pointed out that the Combines Investigation Act is a criminal statute and thus there can be no so-called grey area; that is, there is either an offence or there is not. Furthermore, the Director has a statutory duty to commence an inquiry whenever he has reason to believe that an offence has been or is about to be committed against the Act.

In addition to any uncertainty which it might create, I suggest that any decision to institute inquiries based on the views of one individual as to the economic conditions of a particular industry, or generally, would place the official charged with enforcement of the statute in a completely untenable position.

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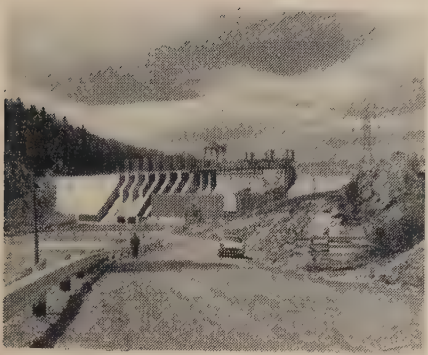
*An apparent inconsistency in the argument: the bankruptcies that result from a price leader's ruthlessness may be of the kind deplored earlier by the author.—Editor

Which source of power serves best . . .



Hydro?

Thermal?

Nuclear?

CANADA'S POWER SHOW

The show window for Canada's power engineering industry opens December 7

The biggest power show in Canada will be held in Toronto on December 7-8-9. Some 6,000 power engineers, consultants, and plant superintendents are expected to attend.

A three-day Power Engineering Seminar will be held simultaneously with the show. Both the show and seminar are sponsored by the Institute of Power Engineers, which will be holding its 1961 Annual Convention in conjunction with the other events.

Experts from the Canadian and U.S. power industries will present technical papers on latest engineering developments and maintenance techniques. Samples of the papers to be presented are:

First Citric Acid Cleaning of a Large Canadian Utility Boiler by J. Heffernan of Dearborn Chemical Company;

Steam Turbines – Types Available by W. J. Hennessey of Canadian Westinghouse;

Aids to Boiler Efficiency Testing from the U.K. by A. C Wilson of Airflow Developments Ltd.

Lakeview generating station, Ontario's largest thermal-electric plant, will be described by R. S. Pettibone, senior mechanical design engineer with Ontario Hydro. He will speak on the design and operation of the $250 million station.

Guest speaker Hon. Robert Macaulay, Ontario's new minister of Commerce and Development, will present "A Forecast on the Development of all Canadian Energy Resources" using scale models and slides to illustrate his talk.

Special technical session

At a special technical session the question, "Which Fuel?" will be discussed by top executives of the coal industry, the gas industry and the oil industry.

Canada's nuclear power stations will be described at another special technical session by George H. Williams of Atomic Energy of Canada Ltd. The introduction includes a brief description of how heat is generated in a nuclear reactor. Canada's two nuclear reactors, NPD and CANDU, will be explained, with particular emphasis on the features that identify them as Canadian. The training of nuclear power operators will also be discussed.

During the three-day show and seminar, exhibitors will demonstrate equipment and services. The original show was staged in 1945 at the request of manufactures who wanted a show window for Canada's power engineering industry. Everything in the range from the large steam generator to tiny electronics will be displayed. Location of the show is the Queen Elizabeth building, Exhibition Park, Toronto.

Any savings from outdoor plant?

Pace of thermal innovation remains high, but new problems keep cropping up

By C. S. WIFFEN and B. WOOD
Merz & McLellan

The size of turbo-alternators at a given speed has traditionally been limited by the rating of the alternator. About 1924 the limit rose to 25 Mw at 3000 rpm. It gradually climbed with the same techniques of air cooling to 50 Mw and even to 60 Mw as early as 1931 in Europe. The introduction of hydrogen cooling changed the picture, 60 Mw became easy, and without great alterations ratings up to 100 Mw became possible at 3000 rpm, or about 75 Mw at 3600 rpm in the U.S.A.

More recently "inner" cooling has come into use, which so greatly relieves congestion in the rotor as to render the stator the limiting feature. Consequently new methods are being adopted for more intensive stator cooling, making use of a liquid, either purified water or oil, circulated through the hollow copper conductors. This has already raised the limit rating, set by transport weight, to about 500 Mw. The largest alternators at present in service in Europe are several of 200 Mw, while at 3600 rpm a 325-Mw alternator has recently gone into service at the Helena station of Middle South Utilities. Some degree of scope for variation of kw rating of a given machine is offered by varying the rated power factor, the short circut ratio (SCR) and the hydrogen pressure. Increase of rating on a given frame size inherently tends to lower the SCR, and figures as low as 0.4 have been adopted: 0.64 is regarded as standard.

The rotor forgings of these sets are not much larger that what would have been employed for sets of 60-70 Mw with air cooling. The reduction of weight per kva of stator without liquid cooling is not so startling. The hydrogen pressure is now commonly 40 psi. Efficiencies are not greatly affected, but may be slightly worse. Water-cooled stators are in use in England at Bold and Tilbury and the first oil-cooled stator in the U.S.A. was put into service at Eastlake in 1956. Breed and Philip Sporn 500-Mw supercritical units have oil and water cooled stators, respectively.

The new designs have brought with them considerable complication and refinement of the copper conductors in the rotor which are now no longer the rather crudely bent strip on edge at one time traditional. Since temperatures are now more closely controlled and sometimes also the copper is alloyed with silver, rotor copper distortion which put a large amount of plant out of action a few years ago is now not expected to occur. The exciter assumes very large proportions compared with the alternator, and its drive and that of the hydrogen circulating fan (if used) become a major factor in design, each firm having its own solution not necessarily yet crystallized.

Boiler feed pumps and their drive

Higher pressures bring in a new factor, that is, the very great increase of boiler feed pump power. This was about 1% at 600 psig and would increase roughly linearly with pressure, except that the steam rate also falls somewhat with higher temperature and multiple reheat. At 4500 psig the feed pump consumes about 4½% of turbine output, so a 300-Mw set requires 14 Mw or a 450-Mw set 22 Mw.

This change brings about several new conditions. First the feed pump power can no longer be neglected in discussing the cycle: it has thus become accepted practice (as was always the case in Britain) to include the temperature rise put in by the boiler feed work in the water and to credit the turbine with it. Thus gross turbine heat rates in the U.S.A. have apparently improved. The corresponding work is, of course, deducted in getting out the station heat rate, but not ordinarily in the turbine heat rate—though there is no reason why this should not be done to give a realistic net turbine heat rate including boiler feed pump, as is common practice on the continent of Europe.

Secondly, the power required to drive a 100% rated pump has gone up to the order of 8000 to 40,000 hp, depending on the size of unit, and can go still higher. This has caused some designers to think that motor drive is inapplicable and to put the boiler feed pump on the tail of the main turbine shaft, as at Astoria, or to drive it by a separate steam turbine, as at Breed. A gas turbine has also been suggested.

The very large power means that methods of reducing it at part load become important. The only satisfactory method is variable speed, which is beneficial also in reducing wear on the control valves. Secondly, a higher speed than 3000 or 3600 becomes desirable for all except the very largest pumps. When step-up gears are used it is advantageous to use a 4-pole motor.

Squirrel-cage motors with hydraulic couplings or slip-ring motors are, however, still in the picture.

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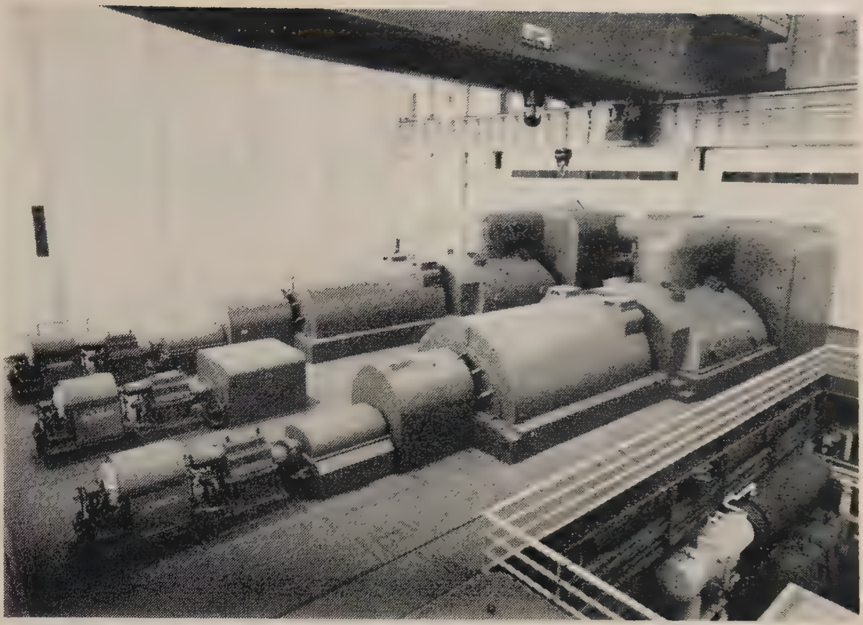
*This article is the third and concluding part of a review of thermal generation of electric power.—Editor

There are various possibilities, e.g., for smaller units half the pump can be driven at constant speed and the other half at variable speed, both from the same motor, so keeping within limits of hydraulic couplings (as at Philo). Electronic frequency changers have also been suggested; but although their cost has steadily decreased over the years, they are still too expensive for this application at the present time. Alternatively a steam turbine can do the job more elegantly and without slip losses. This has caused a reversal of the former swing away from steam-driven auxiliaries.

The boiler feed steam turbine is now of a sufficient size to design for high efficiency at, say, 7000 rpm. It can utilize steam at lower pressure, e.g., from the cold reheat line, and discharge to its own condenser or into a feed heater. In this case, unless provided with an alternative live steam supply, it cannot run until the main unit is on load. At least a small standby motor-driven pump has to be used at no load and light load, as is the case when the pump is driven from the main turbine shaft. The economics of alternatives is still a subject for debate and has not yet been fully settled. Because the steam in the feed pump turbine carries less superheat, it is more economical to provide bled steam from this than from the main turbine. In several recent plants the main unit is simplified by the omission of the corresponding bleed connections.

Boiler feed pump power can also be conserved in a unitized plant by dropping the boiler pressure at light load, as was done in Germany before 1939. It was thought that sliding pressure operation (Gleitdruck) would not be desirable with supercritical pressure, where the saving would be largest. However, in the light of operating experience with Avon No. 8 and at Eddystone, there can now be no objection to dropping to subcritical pressures at part load. Indeed, the need to avoid distortion by admitting steam all round the annulus means that full pressure at part load could only be held by throttling.



Six 1,055,000 lb/hr boiler feed pumps of units 1 and 2 at Bergen, N.J. Four pumps are driven by hydraulic coupling, and two by motor and gear

Other auxiliaries

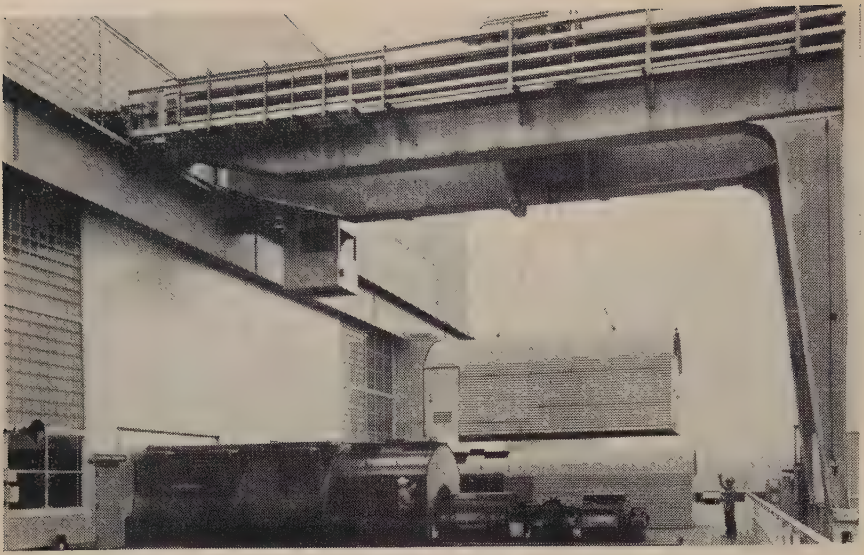
With the avoidance of the ID fan and adoption of a better cycle, other auxiliary power tends to diminish in proportion. A larger FD fan can do the same job as FD and ID and at less expenditure of power, since it pumps cold fluid. Also there is less of the infiltration which hitherto partly accounted for high ID power when using balanced draught. Circulating water pumps, formerly the largest single auxiliaries, taking 1% or 2% of power generated according to conditions, i.e. open circuit or cooling towers) now tend to take a lesser fraction as cycle conditions improve, since the heat rejected per kwh falls markedly, e.g., it is equal to the heat utilized in the latest plants, whereas 25 years ago double the heat utilized had to be rejected.

In the U.S.A. reciprocating air pumps are in wide use often together with steam jet air pumps supplied off the cold reheat line and therefore not usable when starting up. In continental Europe the water jet ejector has been in regular use for some forty years. It is more efficient and less costly than the steam jet ejector, but its use had not until recently penetrated elsewhere. However, the supply of steam ejectors from high-pressure and high-temperature steam ranges is becoming inconvenient as well as absurdly wasteful.

The rapid increase in size of units throughout the world and the use of higher boiler conditions have brought many new problems to the feed water heater designer, especially in countries where statutory regulations insist on dismantling to permit regular inspection. The load on the tube plate and the end plate of the conventional water box becomes intolerable at large sizes and high pressures also. Shell-to-tube plate joints have been a cause for concern particularly where quick starting and two-shifting are required. A number of new designs which avoid the orthodox water box have been developed, and it appears that radical changes from conventional practice are likely to be seen. From the operation point of view all welded heater designs entail some sacrifice in accessibility or tube replacement.

Outdoor stations bring some savings

One of the aims of power station design is to attain a given performance at minimum cost. Very substantial savings in cost per kw are made by adopting large units. With orthodox designs little else can be done except to buy plant at the right time. However, one apparent way to cheapen power stations is to omit the buildings. The out-



Outdoor installation of 1,130,000 lb/hr boiler feed pump, step-up gear and hydraulic coupling at the Mercer station

door idea first caught on in the southern parts of the U.S.A. where summer temperatures are high and winters not too cold. It is especially attractive in gas or oil-fired stations where no bunkers are required. The concept spread to more northerly latitudes (as far as New York) and even to coal-fired stations. The Polymer installation at Sarnia was one of the first outdoor Canadian plants.

The savings that can be made are not as profound as might be supposed. They have been put at about $6 to $10 per kw for an outdoor boiler house. The value of the radiation loss from the boilers, which is ordinarily recovered by sucking hot air from the top of the boiler house, has to be offset against this saving. This is worth about 1%, or, say, $2/kw, though it must be conceded that combustion air can also be heated by low-value bled steam.

A half-way scheme, in which the boiler house takes the form of a light-weight sheet covering supported from the boiler structure, is a more satisfactory compromise for use in climates where either much rain or cold weather has to be allowed for. Placing the turbine in the open can also save money, but few people would accept this as reasonable for cold climates, even with 'walk-in' enclosure of vital parts such as the governor end, and complete enclosure below decks as is usual. The combined saving on boiler house and turbine house has been put at the order of $10 to $20 per kw but in this is often concealed other savings made by general all round economies. These are really extraneous in that they could be made anywhere, but they are difficult to separate in the total expenditure. Where 'walk-in' enclosure for the turbine and special winterising for other parts is essential as is the case for most Canadian plants, their cost largely offsets the savings in buildings. In fact some people say it costs money to go outdoors.

Water preparation

Adoption of high steam conditions has always been dependent on adequate water chemistry. Supercritical pressure can only be adopted if feed water is practically pure. A few years ago present maximum pressures were not practicable because of reliance on distillation followed by correction of pH by dissolved salts. Distillation is now not regarded as good enough. Demineralization can produce purer water than commercial evaporators. Solid substances can no longer be employed for pH correction, for conditioning or for oxygen scavenging. Their role is accordingly taken over by the gases, ammonia and hydrazine. However, this is no revolution; practice has gradually been working that way for some time at lower pressures, and the new supercritical cycles can utilize experience already gained particularly in Germany at 1500 psi.

New techniques are also being devised to preserve high purity of the water, e.g., welding in condenser tubes or sealing the expanded joints in the tube plate with neoprene together with compartmental division of the condenser to separate off contaminated condensate for individual demineralizing. Thus even a sudden leak assumed to be near a tube plate will not result in salts entering the boiler, since the contaminated water supply is shut off automatically and a store of pure water called on. One incidental advantage will be that feed heaters will have cleaner surfaces than ever before and so show a better performance. A further development on the way is the elimination of copper in the condensate system by the use of stainless steel condenser tubes and steel feed heater tubes.

Reverse flow on rivers may let warm water into intake

The rational use of river water for cooling is a subject which receives little mention. However, it is of growing importance. Even large rivers such as the Ohio in the U.S.A. are already becoming warm. Some in the U.K. are already too warm, but the U.K. has sea water all around, and thoughts there are being adapted to make its use feasible.

An interesting problem is how to design river intakes in such a way as to swallow a large fraction of a stream. It can be affirmed that this is rarely done — a large amount of cold water commonly slips past. This means that when abstraction is anywhere near the full river flow, other water must recirculate from the outlet back to the inlet in reverse flow on the surface. Thus the river is not properly utilized. Some people will find this difficult to believe, but there is no doubt that it occurs, unless there is a weir interposed. Thus the distance of separation between intake and outlet assumes some importance. This 'pond' may lose very little heat to the atmosphere, but will nevertheless show considerable drop in surface temperature brought about by interchange between the two oppositely flowing currents which are separated by their densities. The resulting heat transfer between them calculated from observed figures is many times the loss to the atmosphere.

In England, where there are few large rivers, generation has come to depend very largely on large natural draught concrete cooling towers — these will be used for even 2000-Mw stations. Ratings are as high as 6 million imperial gallons per hour, base diameter 266 ft and height 350 ft. They can produce as much cool water over the year as an overloaded estuary, and they allow the exploitation of inland sites near the collieries which have good foundation conditions. Economically they are a much better proposition than the mechanical draught towers fashionable in North America. They are little more expensive in first cost, but have a longer life, involve no fan power and less maintenance; they completely prevent recirculation of air and are more reliable.

A further European development is the air-cooled condenser of which there are two types. One, of German origin, condenses steam direct and uses no circulating water. Sizes up to 32 Mw are built. The second employs a dry extended surface cooler in conjunction with a jet condenser working on recirculated re-cooled pure water. A 120 Mw natural draught unit about to come into service at Rugeley, England, was built as a research project, since its use is commercially uneconomic at normal prices of make-up water. A serious risk which applies to either form of air cooled condenser is that of freezing but otherwise a cold climate is advantageous since the vacuum is determined by the dry bulb temperature and not the wet bulb as in a wet cooling tower.

Gas turbines

Gas turbines are not new. They had a long and chequered history before Whittle. The first undoubtedly successful one, in that it fulfilled its guarantees, was the historic 4000-kw machine for Neuchatel run in 1939 and exhibited at the Swiss National exhibition. Mention of the gas turbine has been made so far only as an adjunct to a steam cycle, but it can, of course, given suitable fuel, stand on its own feet. Canada has the largest capacity of gas turbine driven generating plant installed in the world. Favourable conditions are the demand for high output in cold weather, not too large a unit size (say 30 Mw) and either a cheap clean fuel, such as natural gas, or a not very high utilization factor. This means that a very high efficiency is not called for, but a low capital cost compromise is acceptable.

In England the high hopes at one time placed on the gas turbine because of its success in the air are still far from realized. It has not achieved much of value either in generating stations or locomotives, and coal-firing is still in the distant future in spite of the work of Mordell at McGill University. However, memories of unsuccessful large land gas turbines are being erased and attention is turning to the use of adapted aircraft engines burning distillate fuel; two 3-Mw units are in service and one 15-Mw unit is on order for peak-lopping. Disillusion was not confined to England, as similar disappointments have been experienced in other countries. To some this was no surprise, it is a common failing to attribute to the unknown competitor all the hopeful virtues and to the established one all the known practical drawbacks.

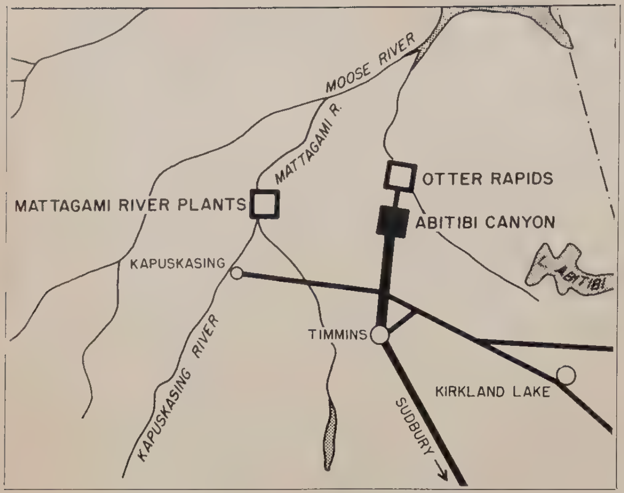
There is a curious irrational glamour about the gas turbine and its forerunner, the gas engine, which has its roots in some mistaken claims by early thermodynamic experts. In this connection it is worth recalling that Sir Frederick Bramwell prophesied in 1881 that "within 50 years steam machinery would be found only in museums" and bequeathed a sum of money to endow a lecture to be delivered 50 years later reviewing power generation. Sir Alfred Ewing in giving the lecture in 1931 had to report that it was the gas engine that was practically dead and steam in most fields still very much alive. Since then the internal combustion engine has cut severely into regions once occupied by steam, e.g. in transport of all kinds. Steam is, however, still the most economical choice for large thermal power generation and that position is not likely to be altered even by present developments in atomic power. Engineers need have no shame in still using what they may be taught is an inherently unsuitable fluid. It is paradoxical that water, owing to its thermodynamic shortcomings, is the most economical to use of all the fluids we know.

Novelties and their origins

It is worth pointing out that few features mentioned as used in modern top class stations are really new. Multiple reheat was patented by Ferranti 1905. Reheat and multiple stage feed heating were used in 1916 at Blaydon Burn. Reheat was used in 1918 at North Tees, England, and served as a model for the original Philo No. 1 in the U.S.A. (1924). The Barking 'A' symmetrical 2-shaft set with two high-speed lines and 4 exhausts has been mentioned (1922). The Benson supercritical boiler was invented by Mark Benson, a Czech living in England, and the rights were sold by English Electric to Siemens Schuckert in Germany, who did the major development work, leading to more than 300 sub-critical Benson units in Europe and also the first supercritical plant at Huels (1956). Direct cooling of rotor copper was patented in Europe in 1909 and was in use in 1934. Several water-cooled rotors were in service at Carville 'B' in 1916 and at Dunston 'A'. Oil cooling of alternator stator windings was tried by Parsons as early as 1889 and water cooling by 1904. It was again in use in 1957 at Bold. Three gas turbines were built by C. H. Merz as a private venture between 1901 and 1909, though none of them turned themselves round. The combination of gas turbine and unpressurized boiler was the subject of a report on Dunston 'A' in 1938, but was not thought an invention, since the Velox boiler already existed in 1931.

Otter Rapids

The harnessed Abitibi River



The Otter Rapids hydro-electric dam is only one of the many Ontario Hydro is building to harness water power for the rapidly growing industries to the south. Two more generators are to be in use by 1963 bringing the Otter Rapid capacity up to 172 megawatts. Below: the dam as it now looks with two units in operation

Northern Ontario's turbulent Abitibi River flowed smoothly into harness as Ontario Hydro's new Otter Rapids power station began feeding electricity into the provincial grid.

The hydro-electric station is less than 100 miles south of James Bay into which the Abitibi River drains. Power from Otter Rapids is transmitted to the Abitibi Canyon hydro-electric station, 23 miles upstream, and from there is moved into the combined northeastern and southern Ontario system.

power fed into provincial grid

in northern Ontario is now producing 86 Mw—and more to come

Preparatory work is already underway on an e-h-v line to carry power from the Abitibi and Mattagami Rivers to markets in the south. The first stage calls for a line from Abitibi Canyon to Sudbury. The transmission line will carry power at 460,000 volts. Highest voltage now used in Ontario is 230,000 volts. The e-h-v trunk will eventually extend to Barrie, some 400 miles.

Two units of the Otter Rapids plant are now in operation and two more will be in operation by 1963. Each is rated at 43,000 kilowatts. Provision has been made for four additional units, which would raise the capacity to 340,000 kilowatts. The Abitibi Canyon station has a capacity of 232,000 kilowatts and is presently the largest in northern Ontario.

Construction of the $39 million project began in the spring of 1958. The banks of the Abitibi at the Otter Rapids site were high enough so that little clearing was necessary in the headpond area. A small island made river diversion easier.

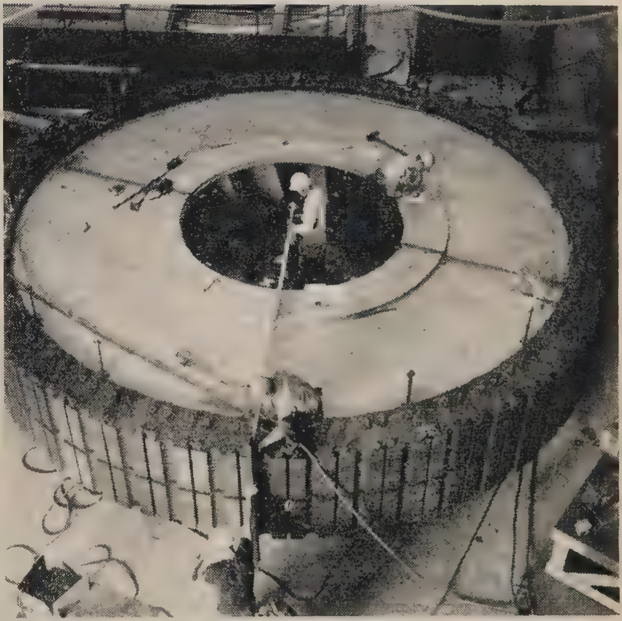
Conventional timber-cribbing was used for only one of the four cofferdams built, resulting in considerable saving of time and money. Steel grills, which were dropped into place by a system of cables and winches, were used to hold the rock fill at the start of placing.

Other construction features included extensive pre-engineering of formwork and use of low-lift, 7-foot pours in the gravity sections. Accessible cantilever forms made it possible to place concrete by bucket.

The main dam and powerhouse is 2,200 feet long and 166 feet high from tailrace to headworks. Converting the latent power of the river into electric energy involved placing 260,000 cubic yards of concrete, excavating nearly 600,000 cubic yards of rock and earth, and using almost 500,000 tons of sand and crushed rock.

Turbines are vertical shaft, fixed-blade, propeller type, manufactured by Canadian Allis-Chalmers. Their rated capacity is 60,000 hp at 138.4 rpm. Rated head is 107 feet. Governors are electric-hydraulic type by Woodward Governor Company. Headgates and sluicegates were supplied by Dominion Bridge.

The main power transformers, which step up voltage to 115 kv for transmission, were specifically designed for Otter Rapids to meet the special requirements of the project. Built by Canadian Westinghouse, these transformers are rated at 150,000 kva. They have one low voltage winding at 13.8 kv, and two high voltage windings at 230 kv and 115 kv, three-phase, 60 cycle. A motorized internal high-voltage switch can change the secondary to either 230 kv or 115 kv.



Because of their size the generators were assembled at the site. Men are assembling rotor that became part of one of the 400-ton, 37-foot diameter generators now in operation. Built by Canadian General Electric, each generator is rated at 46,000 kva, 13.8 kv, three-phase

View of dam before flooding. Note island behind dam

Transmission to the Abitibi Canyon station will be at 115 kv until 1963, when two more generators come on line, and the transmission voltage will then be raised to 230 kv.

New designs may lower cost of aluminum substation structures

Triangular columns and masts reduce weight without changing fabrication costs

The advantages of using aluminum in the construction of substations have long been recognized but early designs followed too closely those of steel structures resulting in high initial costs.

Small test stations began to appear in Canada in 1949. After an experimental model was set up and tested at the Kingston Works of Aluminum Company of Canada, the company introduced these structures at its various smelter sites from coast to coast.

In 1950, Saguenay Electric, Quebec, installed the first of a series of 22 all-aluminum substation structures. Utilizing the light weight of aluminum, these structures were put together by Saguenay employees on location. All designs adhere to the company's dimension specifications which provide for a structure 21′ x 21′ x 24′ high, using about 4000 lbs. of metal. The company will shortly erect a prefabricated welded aluminum structure of the new "Alrectic" design.

Kingston test station erected in 1949

Alrectic design competitive

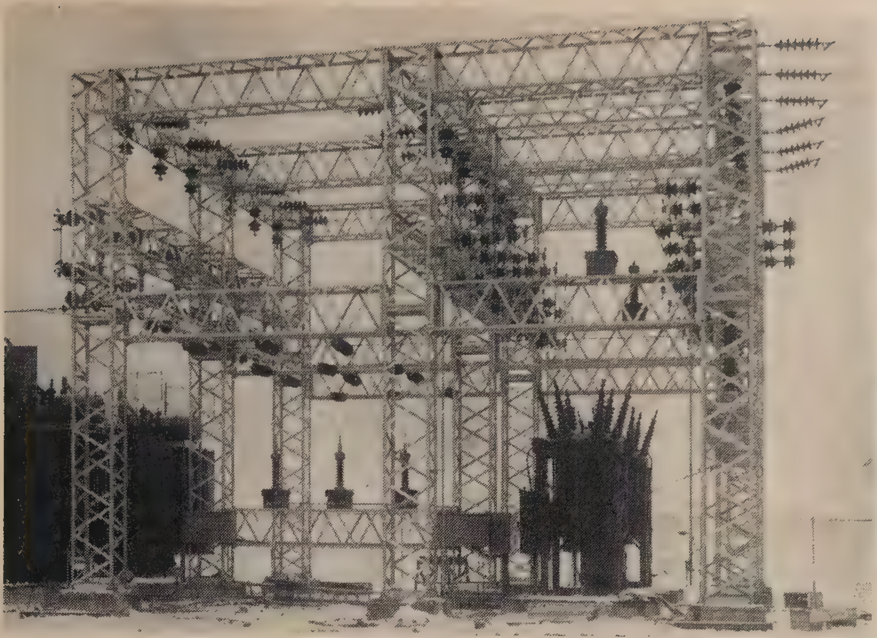
The introduction to Canada of the Alrectic system by the Kearney Corporation of Guelph, Ont., is an innovation which places aluminum structures on an economic par with competitive metals. This method uses specially extruded shapes (practical with aluminum) designed to utilize aluminum's weldability while minimizing the extent of annealing at weld joints. The new design incorporates bulbs on the corners of the angles where lacing is welded. A simple modification of the die from which the aluminum is extruded is all that is required. The significant reduction of annealing at the section effected by the bulbs results in greatly improved mechanical characteristics and reduction in costs. Standard columns and beams are fabricated in the shop and set up in the field with a fraction of the time and labor required to assemble a bolted structure. The light weight facilitates handling, transportation and assembly of parts. Cranes of smaller capacity can be used, and some small stations have been erected by hand.

Another feature of this design is the use of aluminized bolts. A relatively new process, aluminizing consists of hot-dipping steel bolts in pure aluminum, forming a metallurgical bond between the two metals. Extensive tests indicate that aluminized steel has three times the life of galvanized steel.

Alcan itself builds all the stations required for its hydro-electric projects in aluminum because of the need for a material resistant to heavy industrial atmospheres. The pioneer structures containing a few tons of aluminum have been completely dwarfed by the tremendous projects that have succeeded them.

Isle Maligne installation

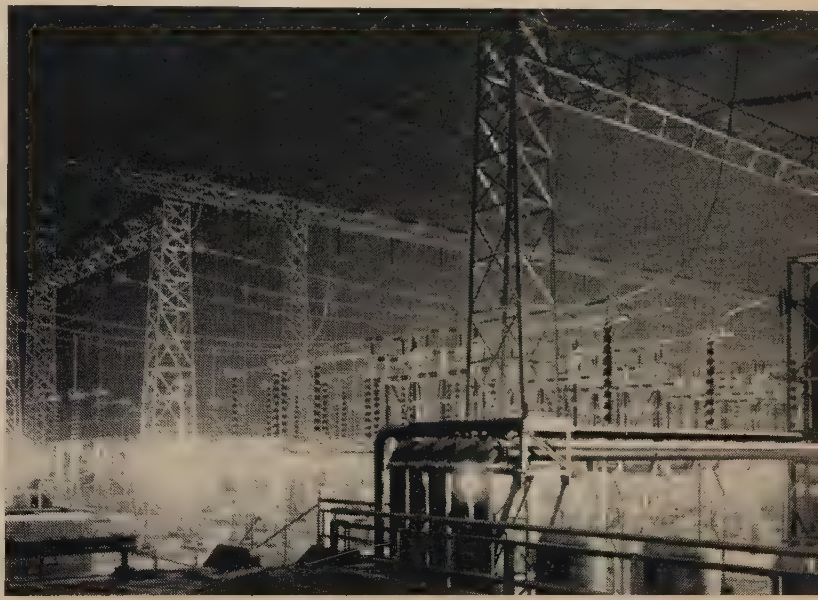
The first large installation was that at Isle Maligne, Quebec, built by Canadian Bridge Works in 1950 using 50 tons of aluminum. In 1954, 66 tons went into the Chute-a-la-Savanne station in



Alrectic structure for Eastern Light & Power Company at Sydney, Nova Scotia

Alcan designed triangular masts and frames used in new 345-kv terminal station at Isle Maligne

Erection of Alrectic substation structure near Beauharnois, Quebec, by Shawinigan Water & Power Company



Chute des Passes — largest all-aluminum substation in the world

Quebec. There are now about 150 tons at Alcan's Kitimat project.

The most impressive is that at Chute des Passes, Quebec. Covering 6½ acres, this 345-kv station, containing 158 tons of aluminum, is ranked as the largest aluminum station in the world. This station design followed accepted concepts of rectangular construction with standard angles. In this project, however, a trial structure was set up which introduced triangular columns and masts. This demonstrated how weight could be reduced without changing fabrication cost. Using splayed channels, this type of column was so highly regarded as to be used exclusively in Alcan's new station at Isle Maligne. This 345-kv station, which enters operation this month, is an outstanding example of how design can effect the most efficient use of material.

Chute des Passes — showing standard construction at the left, and new, triangular columns at the right

European safety rules could affect Canadian exports to many countries

By W. P. Lowell*

Europe is facing a lamp shortage this winter, so many thousands of lamps are being made in Canada and the USA for shipment there. Of help to the exporters is a lamp-and-ballast specification—one of the many drawn up by the International Electrotechnical Commission (IEC). Canada recently began to play an active role in the drawing up of these specifications.

Three general fields are covered by international specifications in the lighting field. Products are handled by the IEC, and safety rules by the International Commission on Rules for Approval of Electrical Equipment (CEE). Illumination requirements are discussed at great length, but rarely specified, by the International Commission on Illumination (CIE). These three commissions try to establish workable and meaningful standards, and it takes much time and many compromises.

The IEC Technical Committee on lamp bases is currently working on a list of "preferred types", hoping that eventually the number of types may be greatly reduced. On fluorescent lamps, the North American types predominate, because we were in with more types ahead of Europe. On fluorescent ballasts, the subject is much more involved. The best European ballasts bear little resemblance to the best products of North America, because of 50 cycles instead of 60, wide spread of supply voltage requiring taps (in Europe) and the influence of the CEE safety rules.

Lighting efficiency is not everywhere regarded as highly as in North America. This ornate cluster of lights in a Moscow street (with Kremlin in background) is offered by the author as an example of low lumen-per-watt output

The nearest Canadian counterpart of the CEE is the Canadian Standards Association. In North America, our whole philosophy is that equipment and installations must be adequately safe in reasonable practice. We assume ordinary intelligence in the use of electricity, and do not hope to completely protect the fool. On the Continent of Europe, the philosophy is that safety must be absolute, and the fool must be protected from his folly. Their rules are therefore stricter than ours. There is also some evidence that some of the rules might be used as trade barriers to partially replace the tariff walls that are tumbling down. All of this makes the CEE and to a lesser extent, the IEC, a difficult situation to live with.

If India and Indonesia and Brazil elect to use non-IEC standards and *follow the European ideas,* these markets will be closed to us. I am glad to see that Canada is now on the verge of being active in the lamp committees of IEC and CIE. Our comments and ideas are respected and in many cases accepted by these international groups.

General lighting is not covered by international standards. Such standards and many other important factors of illumination are discussed in CIE, but this matter of general lighting requirements cannot be settled in an international standard. Why? Because economic circumstances differ so widely from one part of the globe to another. In northern Europe a skilled workman may receive one-third the wage of his North American counterpart, while controlling power that costs three times as much. Obviously, it is economically justified in North America to spend more money for more footcandles to help that expensive labor produce more units per hour.

This is at least a partial explanation of the wide difference between the new IES Code of Great Britain, and the recommendations of our IES Handbook. For example:

INDUSTRIAL BUILDINGS—INTERIOR LIGHTING

IES Code (Great Britain)		IES Recommendations (U.S.A.)
Rough Assembly	15 ft-cd	30 - 50
Medium "	30 " "	100
Fine "	70 " "	500
Very Fine "	150 " "	1000

This is an example of the fact that general illumination cannot be specified on an absolute or "scientific" or "eye-saving" basis, but must depend to some extent on relative economics.

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*Mr. Lowell, of Sylvania Lighting Products, Mass., is a Fellow of the IES. His remarks are from an address to the Toronto Electric Club.

Detroit – a pioneering utility

Contributing editor R. E. Jones reports on how an American utility operates

Contrary to the general practice, it is not necessary to have underground vaults for an a-c network system. David Burns, chief of transmission and distributions of general engineering department of Detroit Edison Company, states that placing transformers and protectors overhead is both satisfactory and economical. This is one of a number of ways in which this well-engineered utility has pioneered.

David Burns was born in Richwood, Ontario and completed his engineering education at University of Toronto. He spent a year with Canadian Westinghouse Company and a short time with General Motors Corporation. Following this he joined Detroit Edison Company where his interest has always been in distribution engineering. He is a registered Professional Engineer in the State of Michigan, a member of Engineering Society of Detroit and American Institute of Electrical Engineers. Also, he has been very active on the Transmission and Distribution Committee of Edison Electric Institute.

Detroit Edison serves a territory of 7,600 square miles with a population of over four million. This area, covering the south-eastern and eastern parts of lower Michigan, contains a major portion of the vast automotive industry. In the 406 communities served, there are 1,283,000 electric customers, a 25 per cent increase since 1950. The domestic customers number 1,167,548. In addition steam is sold to 1,489 users.

Detroit Edison's David Burns (left) uses a map to explain the distribution system to Contributing Editor Reg Jones

The system 15 minute peak last December was 2,780,000 kw, 2.3 per cent over 1959. However the kwh consumption increased 6.4 per cent in the same period and has doubled since 1950. The ratio of summer peak to winter peak in both 1959 and 1960 was 95 per cent.

The annual consumption per domestic customer is 3,514 kwh, 102 over 1959, and for commercial it is 24,846.

There is a substantial amount of flat-rate water heating with off-peak contorl by a clock at each service. The booster, which is on the meter, comes on automatically by means of a "flip-flop" switch. The total number of water heater customers is 159,333 and this load is being promoted.

There is a lot of air conditioning, particularly in commercial buildings. A hot spell raises the system peak.

About 1,000 homes are heated entirely by electricity and this load is being encouraged. In 1960, 244 new homes and 168 older houses installed complete electrical heating.

A very large commercial lighting installation is a shopping plaza with a load of approximately 10,000 kva.

The net capability of the system is 4,087,300 kw, which includes 2,200 kw of hydro, the balance being steam generation. In 1962, a breeder reactor nuclear plant of 150,000 kw will be completed. This is the first commercial installation to be made in America. The reactor will be owned by P.R.D.C. of which Detroit Edison Company is a member. Detroit Edison will purchase steam from them. Also, there is exchange capacity of 840,000 kw with Consumers Power Company, Detroit Public Lighting Commission, Ford Motor Company and Ontario Hydro. For the latter there are 120 kv ties at Windsor and Sarnia.

Transmission at present is at 120 kv, but towers are now being erected for a superimposed high voltage system in the 345 to 400 kv range.

Subtransmission

In the vicinity of Detroit, subtransmission is at 24 kv with 41.6 kv elsewhere.

The 445 substations are of various types, depending on the surrounding community. Some have residential type housings and some of the older ones are totally enclosed. Outdoor structures are of steel. Transformers are generally three phase. Voltage regulation is in the stations and outside with pole regulators.

Primary voltage is mostly 4.8 kv delta. In 1959, a start was made on 13.2/7.62 kv wye with common neutral in growing suburban areas. At present, 73 square miles is served at this voltage. Consideration is being given to going to the wye connection on existing lines in remote rural areas.

Secondaries are at 120/240 volts single phase, 240 and 480 volts three phase delta and 120/208 volts wye. Also 277/480 volts wye is available. This is the last year of 120/240 volts direct current as the conversion to a-c is nearly completed.

Poles now are Western Red Cedar in longer lengths, with a growing percentage of Southern Pine elsewhere. The cedar poles are given a full length hot and cold open tank treatment with creosote or penta. The pine has full length creosote or penta pressure treatment. Poles are largely class 4.

Many years ago Detroit Edison pioneered the use of flat top poles instead of the traditional vee roofing.

Each year 8,000 to 10,000 poles are salvaged and made available for re-use by removing the rot and placing the butts in a tank of hot preservative. One of the largest items of pole costs is due to replacements because of age or construction of expressways.

In urban areas, poles are located in back alleys or on easements at rear lot lines. In the rural districts they are often erected on right-of-way on private property. The former have spacing of 120 to 160 feet depending on the width of the lots; in the latter the spans are about 400 feet maximum.

Detroit Edison Company and Michigan Bell Telephone Company have jointly prepared a booklet for subdividers and town planners with pertinent advice regarding co-operative planning with utilities when laying out the streets and lots. Both utilities offer to assist in the early stages of such planning.

Joint use of poles with communication utilities is the standard wherever possible. Attachments are made on a pole rental basis.

he standard primary framing is flat on arms or with steel pole-top pins. With the former, on longer spans, the center phase conductor has a zig-zag arrangement, being attached to alternate right and left pole pins to give greater conductor separation in the span. With 13.2 kv, efforts are made to obtain 24 inches of wood between conductors and grounded equipment.

Crossarms are fir or southern pine, both with penta or cresote pressure treatment. While wood pins have been used in the past, future 13.2 kv circuits will be on steel pins and the trend is to go to steel pins entirely.

Most new primary conductors are bare ACSR or all aluminum, using preformed armor rods.

Secondaries now erected have 1/0 bare aluminum neutral and for residential areas 1/0 neoprene covered aluminum outers.

Compression joints are used with aluminum conductors, a single sleeve being installed on 1/0 and smaller ACSR.

For primary dead-ends, there is one 6-inch disc for 4.8 kv, and one 9 inch on 13.2 kv.

Only a few miles of preassembled overhead cable has been installed and this is in short stretches. Some 15 miles of overhead spacer cable are being tried out.

Extensive use has been made of cabled secondary and ventilation is a factor.

In urban areas, few primary line switches are used except at underground cable risers and at sectionalizing points. On the 24 kv system, there are both manual and automatic pole-top switches. Rural distribution circuits have automatic oil reclosers and sectionalizing fuses.

Triplex services are now installed exclusively. For some years outdoor meters for residential customers have been the standard, using plug-in meters in rectangular boxes.

There are 162,000 distribution transformers, mostly of the conventional type, with a total capacity of 3,400,000 kva. Recently a lot of dual voltage, 4.8/7.62 kv units, with external tap changers, have been purchased. Transformers now bought are 25 kva and larger except for some 5 and 10 kva 7.62 kv. units. Transformers of the higher voltage have cover bushings.

While many three-phase transformers were used

Network equipment feeding overhead and underground. Suburban 7.62-kv pole. Spacer clears dead-end from pole

Large network transformer located in back lane

years ago, the only ones purchased in later years are for overhead 112 kva with 277/480 volt secondary.

The present standard is for transformers to be attached directly to the pole, preferably above the secondary bus except for cluster mounting. Cluster mounting originated with Detroit Edison in 1945 and there are many installations on the system. Up to three 250 kva transformers are erected on a single pole with cluster hardware.

Transformer cases are not grounded on 4.8 kv circuits but are with 7.62 kv. Transformers are 100 per cent protected with lightning arresters. Secondaries are banked in urban areas.

The transformer failure rate from all causes is about 0.5 per cent. Formerly, most transformers were load tested annually with split-core ammeters. Now it is generally done on a three year cycle. The consumption of all customers connected to single transformers is being tried as a method of monitoring load, but it is not so simple to thus calculate transformer loading where there is banking.

Transformer covers are not removed in the field. If they must be opened for maintenance they are sent into the shop.

Street lighting in Detroit

In the City of Detroit, the streets are lighted by the Public Lighting Commission. Elsewhere in the area, Detroit Edison provides this service. All types of luminaire are used, both series and multiple, with a trend to the latter. Control is mostly by photo cells and time switches.

Where the supply to a series system is changed from 4.8 to 7.62 kv, autotransformers are installed to avoid purchase of new constant current transformers.

In the Detroit area, there is a large underground system for primary and higher voltages. This underground system consists of the following:

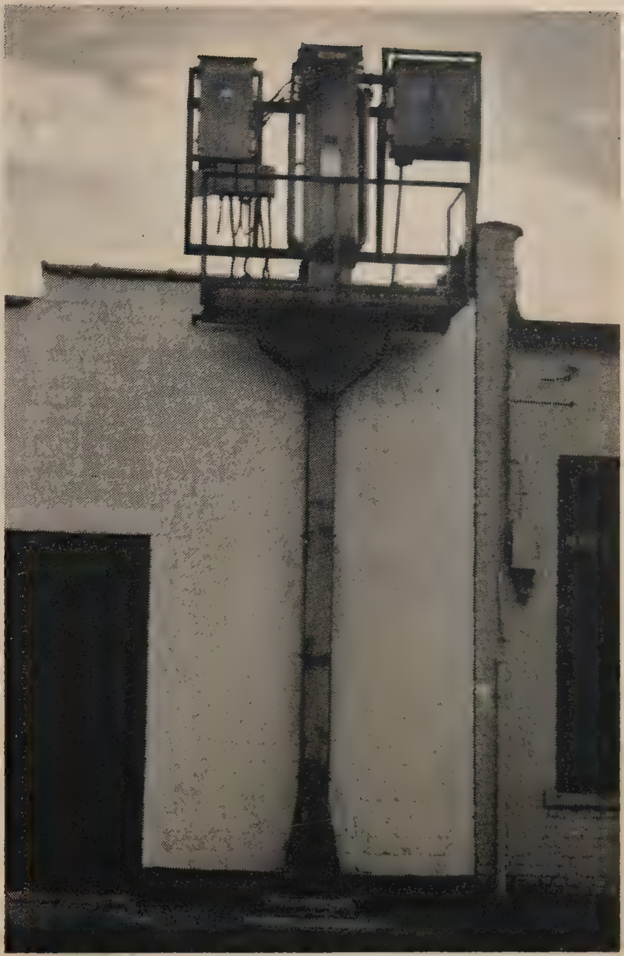
120 kv H.P.Gas	Single conductor	70.6 circuit miles (211.8 miles of cable)
40 kv L.P.Gas	Three conductor	34.6 miles
24 kv		995 miles
13.2 kv		19.5 miles
4.8 kv		909 miles
Direct Current		75.2 miles

In the downtown area, 13 a-c networks at 120/208 volts serve three square miles with a load of 90,000 kva. Feed is at 4.8 kv.

There are 600 network transformers with protectors, 90 per cent being above ground, as there are few conventional vaults. Over 200 of these transformers feed overhead secondaries as well as underground. Units run from 45 to 750 kva each. The transformers and equipment are mostly on a platform on top of one or a pair of vertical 8-inch by 8-inch H beams. These supports give only 11 inches obstruction in narrow lanes and are erected 3 inches from any existing buildings. A few are erected on wood poles.

Modern u/g distribution 35 years ago

About 1925, Detroit Edison pioneered what is now recognized as the modern method of installing underground residential distribution. The transformer was placed on a ground level concrete pad. Overall was a box-like, steel cover split in the middle to open outwards. The transformer fed service pedestals almost the duplicate of the ones now being installed.



Small underground network transformers mounted on pole adjacent to building. Obstruction in lanes is 11″

Underground service pedestal installed in 1925

New underground installations follow a similar pattern with modern transformer housings. Primaries, mostly No. 2 and No. 4 with rubber and lead, are

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enclosed in heavy wall duct. Most secondaries are directly buried. Services are run in conduit to the lot line and from there a protective cover plank may be used in place of conduit. The general contractor digs the trench and the utility does the rest, except for the services which are the responsibility of the customers.

Where there is both power and telephone, the 16-inch trench is 42 inches deep with a horizontal separation between primary and secondary of 8 inches vertical between power and telephone. If for power only, the trench is 36 inches deep. If for telephone only, the 4-inch trench is 24 inches deep. Service trenches for power and telephone are 8 inches by 33 inches with a board over the power cables. These details of trenching are covered in a booklet published jointly by the power and the communication utilities.

Shunt capacitors are used both in the stations and on the lines. They are switched at times. The installations include the following units: 367–15 kvar, 11,957–25 kvar, 2,890–50 kvar, with a total of approximately 600,000 kvar in service.

4.8 kv circuits are worked hot with gloves, but for 13.2/7.62 kv maintenance is carried out with sticks.

For many years this utility has maintained an effective salvage department. It has a two fold objective—saving much useable materials, and at the same time providing work for ex-linemen and others, such as The League for The Handicapped.

Future growth

Mr. Burns had a few thoughts for the future:

The growth of load will continue, probably at a higher rate than at present.

Primary voltages may go higher in the utility industry. Perhaps 24/13.8 kv will be the general answer for new growth areas.

For secondaries, 240/416 volts appears to be advantageous from the utility viewpoint, but acceptance by the public is another question.

The esthetics of overhead lines is of growing concern in the company. The appearance of overhead lines must be improved. The alternative is an increasing amount of overhead cable and underground. There has been an increasing demand for residential underground in the past couple of years and this will continue to grow.

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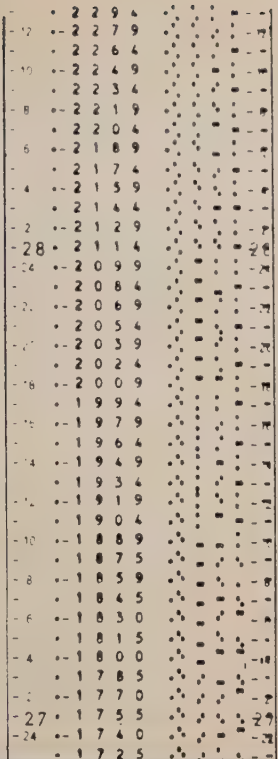

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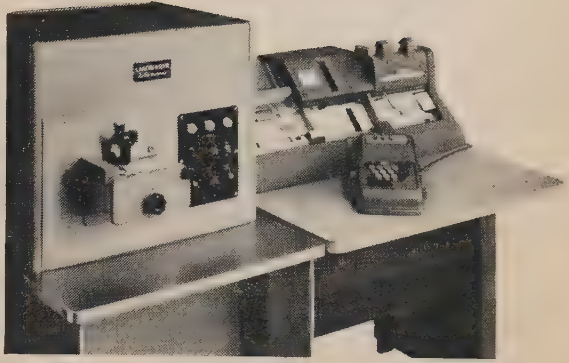

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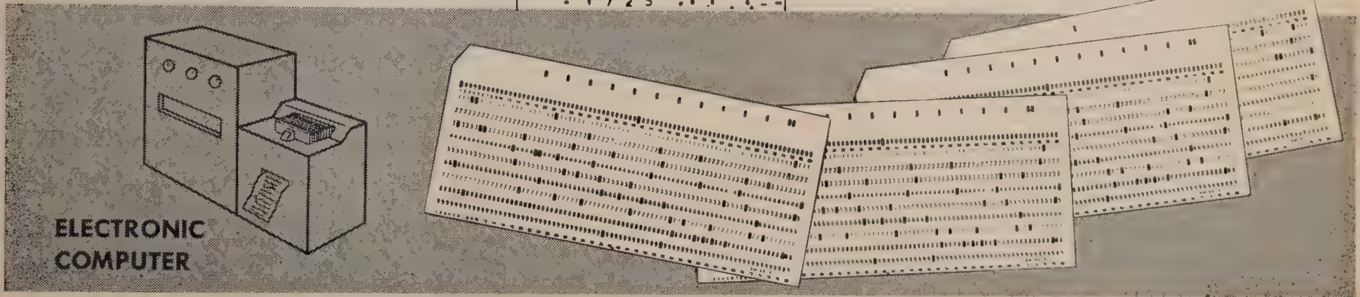

No. 11

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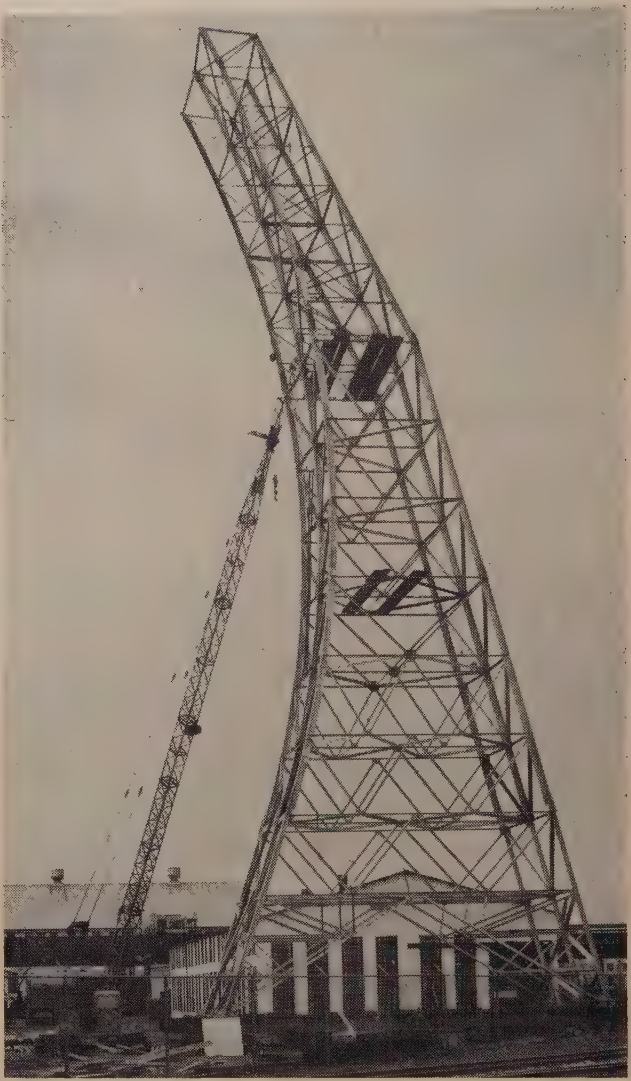
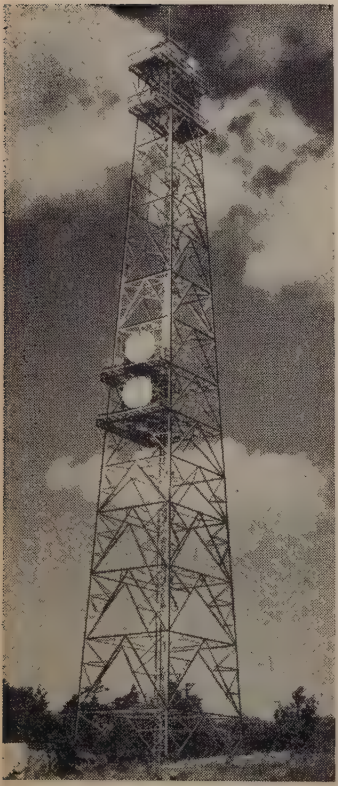
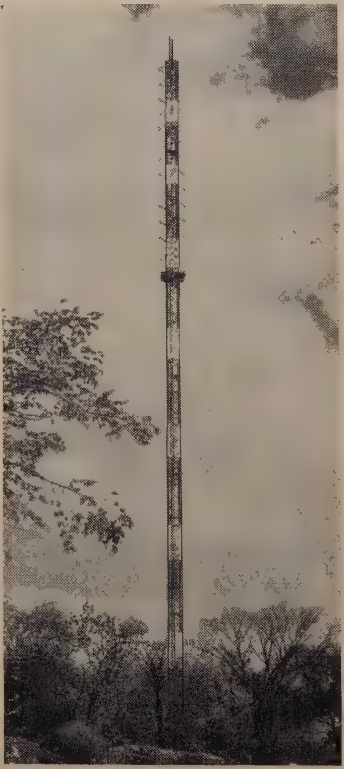


Above: This Tropospheric Scatter Antenna Structure is part of a 120-foot unit fabricated by the Canadian Bridge Works for Western Electric Co. Inc.





Left: Self-Supporting Microwave Tower — a typical Canadian Bridge Works job.

Right: Canadian Bridge Works specializes in all types of TV Towers and Masts.

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MULTI-POINT GAUGES: bulletin 322.11 describes gauges for indicating draft, pressure, differential and temperature. Republic Flow Meters Canada Ltd., Toronto.
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COUNTING UNITS FOR PROGRAMMED CONTROL: 46 pages, illustrated, describes electronic counting processes. Companion booklet has data and circuit diagrams. Phillips Electronics Industries Ltd., Toronto.
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STANDARD RELAYS: descriptions, dimensions, technical specifications and prices for more than 450 variations using 40 standards P & G relays. Potter & Brumfield, Guelph, Ont.
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PRODUCT NEWS

High voltage tester

This model is one of a family of a-c and d-c dielectric strength test sets, or breakdown testers, which, in addition to checking the failure of a specimen, make pre-breakdown leakage tests on a microammeter incorporated in the instrument. A separate meter indicates the output voltage at all times. This permits non-destructive tests as well as the destructive tests required by CSA. Available from Canadian Research Institute.

Use post-paid card, check item 6

Roadway luminaire

Luminaire called the Quadro-liner that controls the lighting pattern on urban and rural roads is available from the Westinghouse lighting division. A unique open-bottom refractor is composed of four individual quadrants or sections. Each section is available in five different designs. Many combinations can be made for a lighting pattern to match almost any roadway lighting requirements. Annoying "spill" light can be controlled and wasted light can be eliminated.

Because of its open refractor, the Quadro-liner can be relamped and cleaned without unlatching or removing the reflector assembly.

The luminaire can use incandescent or mercury lamps up to 250 watts. Photocontrol can be bought with the luminaire to operate the unit automatically. Besides urban or rural streetlighting, the luminaire also finds many general-lighting applications, such as in farm-building areas.

Use post-paid card, check item 7

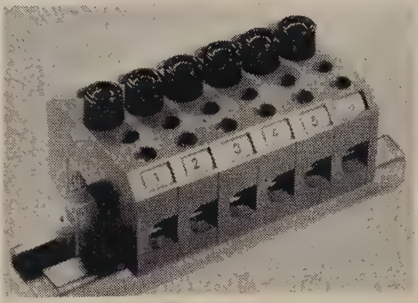
Electric heat control

Compact, low-voltage control system for electric heat, called "Level-Temp", has been announced by White-Rodgers Ltd., Toronto. The system has two components: a sensitive thermostat provides control through a silent operator, which handles the line voltage heating load.

Designed for control use in duct heaters, baseboards, floor register heaters, unit ventilators, etc. Manufacturer claims this control system has overcome problems of noisy relays, oversize controls, high cost, and ambient temperature limitations.

Use post-paid card, check item 8

Terminal block



The advantages of a fused circuit combined with the well-known system of Staffel terminal blocks, is now made available by Electrovert Ltd. through the newly introduced SAKS terminal block which allows the use of non-rewirable cartridge fuses up to 6 amperes for fusing control circuits. Cross connections can be made with jumper bars.

Designed for control centres or individual control circuits of all types, four fuse terminals occupy only 2" x 2" and they eliminate separate fuse holders.

Conductors up to AWG No. 5 are provided for, and the terminal block is rated at 250 volts, terminal to terminal and terminal to ground.

Use post-paid card, check item 9

Ground relays

Three new negative-sequence overcurrent ground relays (Types CRQ, IRQ, and KRQ) are available from the Canadian Westinghouse Company.

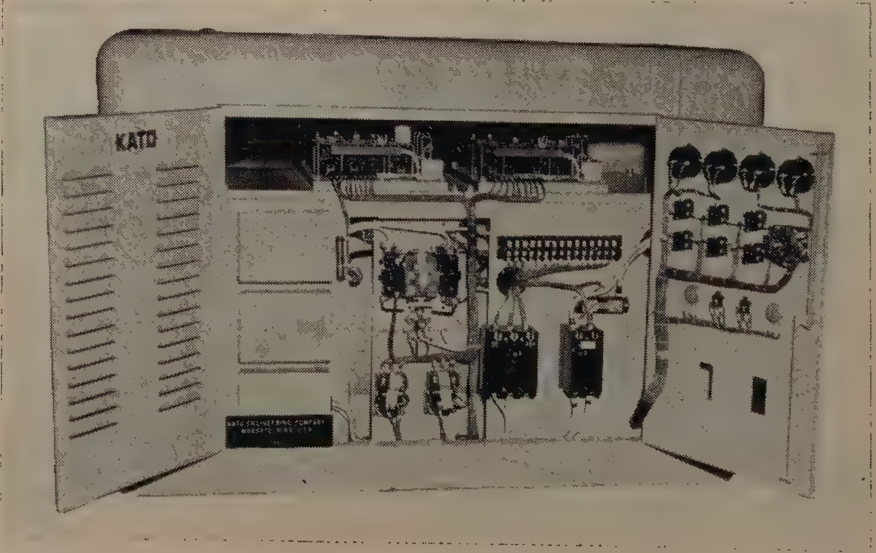
The use of negative-sequence values for the directional element of overcurrent ground relaying is common in locations where zero-sequence values cause incorrect polarization of relays. In locations where delta potential is the only available polarizing choice, the use of negative-sequence voltage to polarize a directional unit of the negative-sequence overcurrent ground relay eliminates the necessity of adding a third potential transformer.

On solidly grounded systems the negative-sequence directional unit is sensitive enough for the new relays to be used without checking the magnitude of negative-sequence quantities under ground fault conditions. The overcurrent units can be set in the same manner as the standard zero sequence ground relays. The new relays may be easily checked in the field for correct installation with load current.

The three relays use the new cylinder unit construction for the directional and instantaneous overcurrent units, and the "E" unit construction for the time overcurrent unit.

Use post-paid card, check item 10

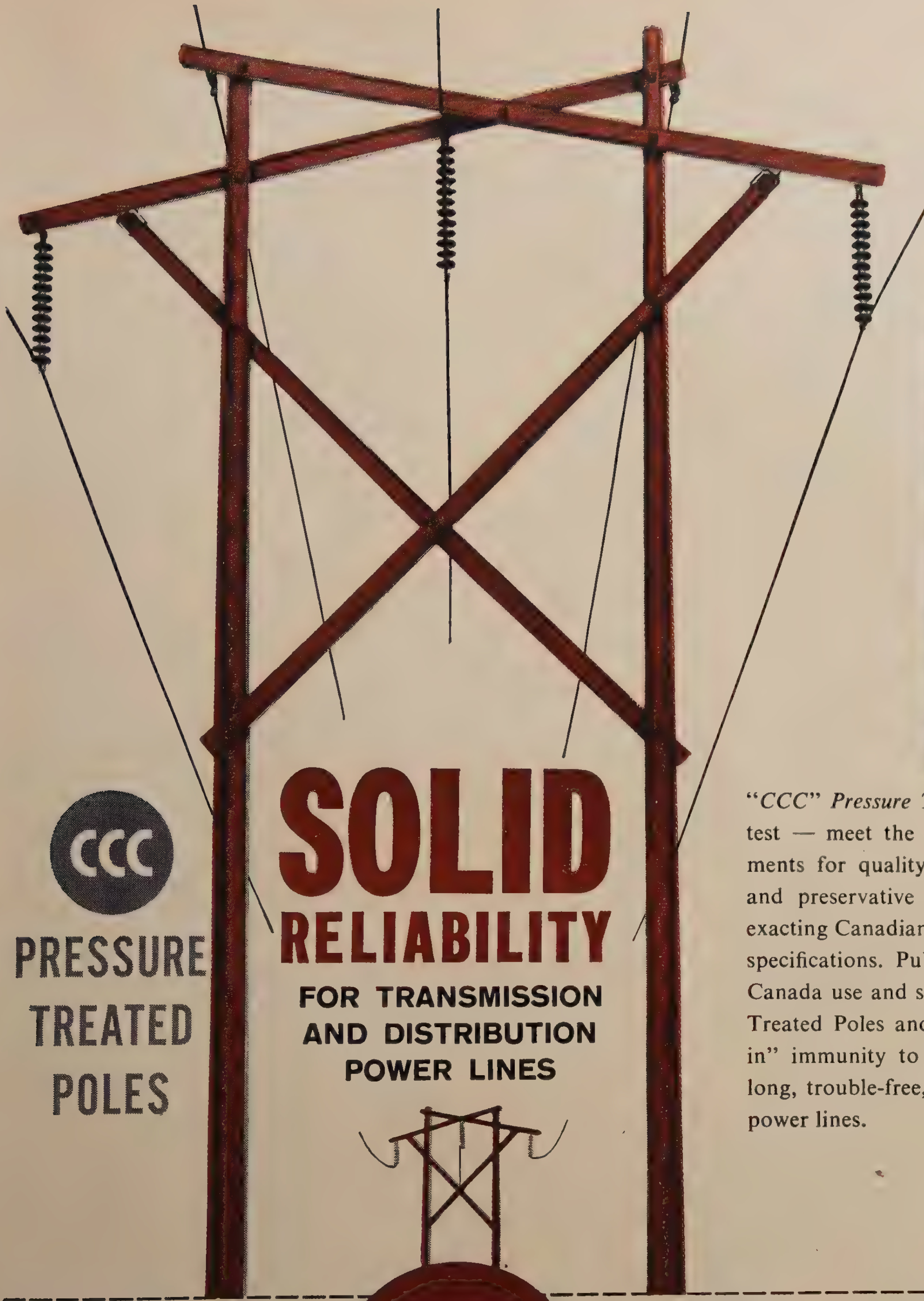
Motor-generator set



Stabilized power source from Kato Engineering Company supplies both 120/208-volt, 400 cycle alternating current and 20- to 30-volt direct current at the same time.

The set is powered by a 20-hp, 550-volt squirrel cage induction motor. The housed unit is mounted on a skid base. A static regulator on both a-c and d-c generators is capable of voltage regulation of 2% from no load to full load. Harmonics are claimed to be less than 5%.

Use post paid card, check item 11



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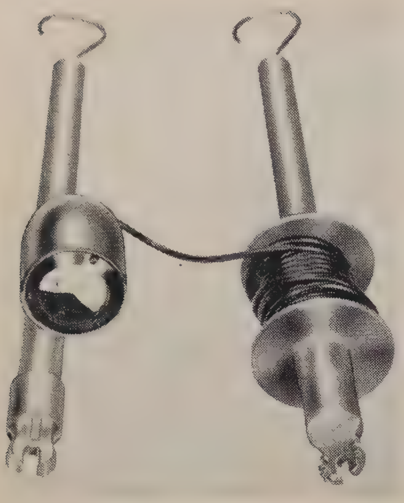
CANADA CREOSOTING COMPANY LIMITED

1400 METCALFE ST., MONTREAL, QUE.

DIVISION OF DOMINION TAR & CHEMICAL COMPANY, LIMITED

Phazing tester



Phasing Tester, available from the A. B. Chance Company of Canada Ltd., is used to determine the correct phase relationship before joining circuits.

The phasing tester consists of two high resistant units and a voltmeter mounted on two epoxiglass insulated housings. The two housings are joined by 22 feet of 15-kv, insulated, flexible cable which is normally stored on a cable reel mounted on one of the housings.

Using universal poles connected to the bottom of the housings, a lineman can safely hook the resistor hooks over the conductors. The tester is first connected across phases on each line to determinate if both are energized. It is then hooked over a conductor of one circuit and to the corresponding phase of the other circuit to make certain that the phases will not be incorrectly connected.

The basic phasing tester is used on voltages up to 15 kv. Extension resistors are available so that the unit can be used on voltages from 15 kv to 75 kv.

Use post-paid card, check item 12

Quartz heating lamp

A high intensity quartz lamp panel for process heating, drying, dehydrating, and similar applications has been developed by Canadian General Electric.

These new compact panels, designated OKZ20, feature a T3 G-E tubular quartz lamp which is unaffected by moisture. Instantaneous heating up and cooling off is a unique feature of the panel, making it suitable for conveyorized production line applications. Possible scorching of product and danger of fire during conveyor failure are eliminated because, immediately the power is shut off, the lamp ceases to radiate heat. There is no latent heat in this lamp panel, no slow cooling off.

Use post-paid card, check item 13

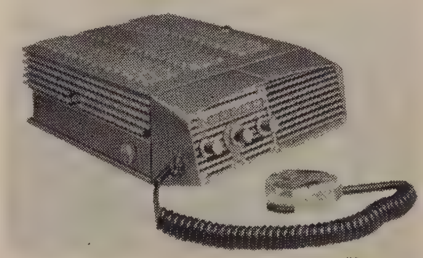
Timers

Heavy duty timers, the Eagle HL series, designed for operation at camshaft speeds from one to 600 rpm, are available from Davis Automatic Controls Ltd.

Typical applications include sequential flashing of lights, control of high-speed machines and life testing. The timer can be furnished with one to 12 circuits for operation on 115 volts, 60 cycle.

Use post-paid card, check item 14

Mobile radio unit



Transistorized VHF FM mobile radio unit for 148-174 Mc/s range intended for use on vehicles with 12-volt systems available from Marconi. Unit designed for mounting flexibility – trunk or front mounting, with control and loudspeaker units separate or together. From one to six channels can be used. Dimensions are 15¾ inches long, 11½ inches wide, 4½ inches high. Weight is 19 pounds.

Use post-paid card, check item 15

Germanium transistors

Three germanium transistors, type numbers 2N1924, 2N1925, 2N1926, introduced by Canadian General Electric, are expected to be a boon for protection in existing marginal high-voltage circuit designs.

In addition to voltage ratings up to 60 volts, the transistors have a high gain characteristic which allows them to be used in audio frequency switching circuits. Available from stock in production quantities.

Use post-paid card, check item 16

Coils and core

DS-3 and DT-3 core and coils designed for use in equipment enclosures such as distribution power centres where individual protective cases are unnecessary are available from the Canadian Westinghouse Distribution Apparatus Division. Space-saving and ease of connection are two benefits of such applications.

DS-3 and DT-3 standard design core and coils are identical to those used in the company's class H insulated dry type transformers. The class H dry type transformers have HV and LV terminals at the bottom, and tap boards with jumper bars.

The power centre design has been developed specifically for this application and differs from standard design in that the terminals, HV and LV, are located at the top of the units. This arrangement is usually more convenient for bus bar connections in power centre applications. Bus bars can be connected directly to the solidly-mounted terminals.

Tap changers are provided on the power centre design, in place of the standard tap board with jumper bars. A thermometer to indicate winding temperature is optional equipment.

Use post paid card, check item 17

Automatic transfer switches

Available from Davis Automatic Controls are 1200, 1600, and 2000 ampere size automatic transfer switches.

These two and three pole switches are the open type, vertical tandem, suitable for control centres. Full relay protection on each switch provides transfer to emergency source when voltage on any phase drops to 70% or less. Retransfer to normal is made when all phase voltages are 90% or more. Sizes range to 600 volts a-c, 250 volts d-c.

Use post-paid card, check item 18

Heavy duty lamp

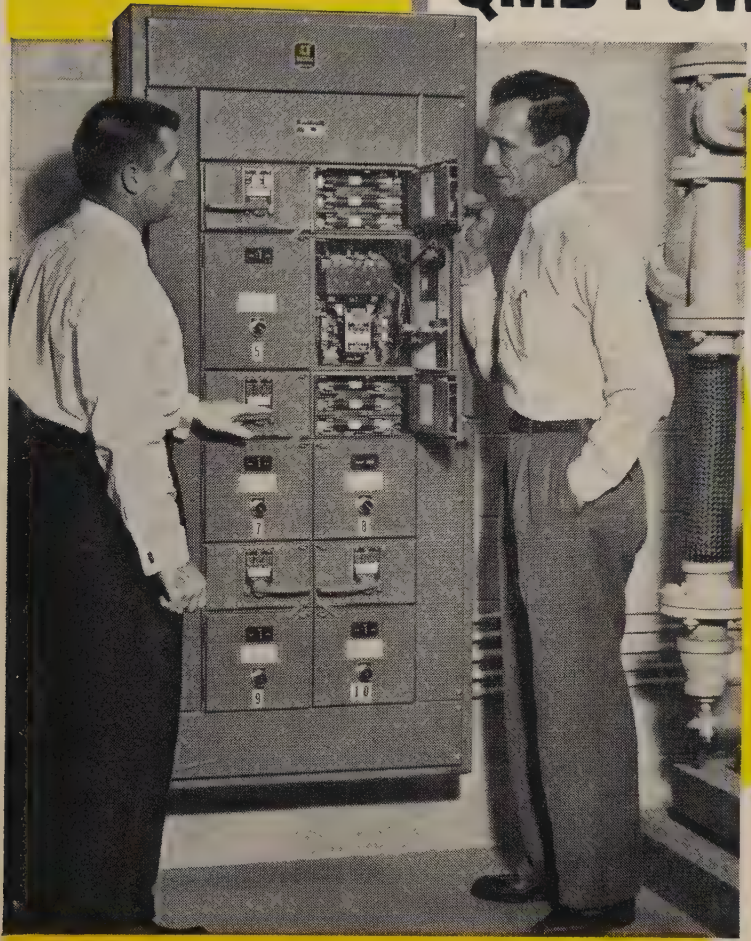
A heavy duty incandescent lamp with 3450 hour life is available from Sunray Electronics (Canada) Ltd.

Unlike regular lamps which usually have one supporting wire, this lamp contains four supporting wires for the coiled filament. They are available in a wide range of voltages and in sizes from 10 watts to 1500 watts.

Use post-paid card, check item 19

SPACE–
TIME–
MONEY– – – –

Save All Three with Square D QMB POWER PANELBOARDS



MOTOR STARTERS AND BREAKERS OR SWITCHES COMBINED IN ONE SPACE-SAVING PANELBOARD!

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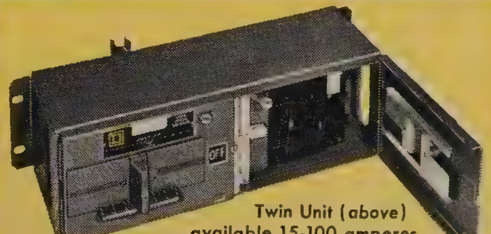
BREAKER AND SWITCH UNITS ARE EXCLUSIVE PLUG-IN CONSTRUCTION. INSTALLED OR REARRANGED IN MINUTES!

If the above installation had been made the old way—with trough, and ganging separate switches and starters—it would have taken at least six feet of wall space instead of 30 inches, and four times the installation time.

After this panelboard is installed, Square D's exclusive *PLUG-IN* design permits circuit changes without costly down time. For extra safety, plug-in units are mounted directly above starters, permitting interlocking. No starter or disconnect door can be opened when switch is "ON."

QMB panelboards accommodate reversing or non-reversing starters, sizes 0 through 4; plug-in circuit breakers through 225 amperes; plug-in switches through 200 amperes (bolted through 600 amperes).



Twin Unit (above)
available 15-100 amperes
Single Unit available 125-225 amperes

Exclusive Breaker Unit Advantages:

Plug-in construction • Each unit in individual steel enclosure with dead-front construction • Combine switch and breaker units in same panelboard, if desired

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It gives you a remarkable new insight into how industry buys.

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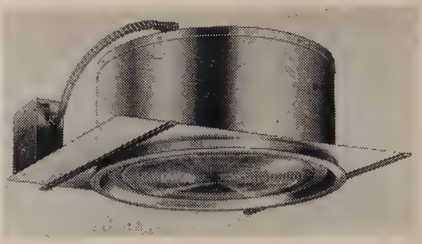
Round fixtures



Aluminum recessed and surface mounted round fixtures designed to take glass diffusers are available from Wakefield Lighting Ltd. Diffusers are regressed above the ceiling to lessen glare and to provide a pleasing ceiling surface. Plaster frame is cadmium plated steel.

Use post-paid card, check item 20

Phase protection relay

A relay (Type IRV) that adds phase protection to the present family of directional overcurrent relays (Type IR) has been introduced by the Canadian Westinghouse Company Limited.

Features include: instantaneous-overcurrent unit that has no transient response, operating with an internally mounted saturating transformer which limits the energy to the instantaneous-overcurrent unit at high fault currents and reduces the burden on the current transformers; a directional unit that torque controls both the time-overcurrent unit and the instantaneous-overcurrent unit; and a time-proved "E" element time-overcurrent unit.

Use post-paid card, check item 21

Low power rectifiers

Designed specifically for low power switching and control applications, a series of silicon controlled rectifiers capable of switching up to 3 amperes of current over a PRV range from 25 to 400 volts is now available from International Rectifier Corporation.

Designated types 3RC2 through 3RC40, the devices enable rapid firing with a minimum of current (2.4 ma @ 125°C) on such applications as computer circuitry, temperature and lighting controls, servo-mechanisms, static inverters, ac and dc motor control, dynamic braking, ignitron firing, welding controls, etc. They will perform highly efficient switching over vacuum tube or mechanical circuitry. All units feature hermetically sealed, all-welded construction, and measure approximately 1.18″ overall length. For detailed data, request Bulletin SR-352. Distributed by Douglas Randall (Canada) Limited.

Use post-paid card, check item 22

Explosion proof air heater

Tested and approved by Underwriters' Laboratories, under Class 1, Group D, this explosion-proof electric air heater by Canadian Chromalox Company Limited is designed for installation in hazardous atmospheres in industrial areas.

The heater can automatically provide the amount of warmth desired with complete safety in areas where gasoline, solvent or other fumes are present. It is constructed of a steel framework and a heavy-duty, metal-sheathed brazed fin heating element. This element has a low watt density and is embedded in a compacted refractory.

The heater is available with a 3000 watt capacity on 208, 230, 288, or 460 volts. Dimensions are 17″ high by 35¾″ wide by 6″ deep.

Use post-paid card, check item 23

Floodlight mounting

Availability of an all-aluminum mounting channel which permits several PAR floodlights to be mounted close together and aimed in different directions, has been announced by Canadian General Electric.

The mounting channel is designed with twelve threaded mounting openings. Nine of these are sealed by means of bakelite plugs which can be easily removed, if required. Two wiring terminal strips inside the channel facilitate easy connecting. A cover plate on the back permits quick and easy access during installation and with the aid of a gasket and two screws seals the unit against weather. The light weight channel may be threaded on any one-inch threaded pipe or mounted on threadless posts by means of a slip-fitter post-top adapter.

Use post-paid card, check item 24

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At National Porcelain, careful packing of insulators is but the *final* step in a long series of quality controls leading to top performance on power projects across the nation.

Manufacture of NATIONAL PORCELAIN products begins with certified clays and the finest glazes. Every NP insulator is tested and inspected individually. We exceed recognized standards by meeting our own. This individually guaranteed standard of quality is assured both for custom engineered insulators and the many standard lines listed in our insulator specification catalogue.

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MANITOBA: National Products Company, Winnipeg. SASKATCHEWAN: Thurman Supply Company, Regina and Saskatoon.
ALBERTA: R. L. Brews & Son Limited, Calgary and Edmonton.
BRITISH COLUMBIA: Canadian General Electric Company, Vancouver and Victoria.

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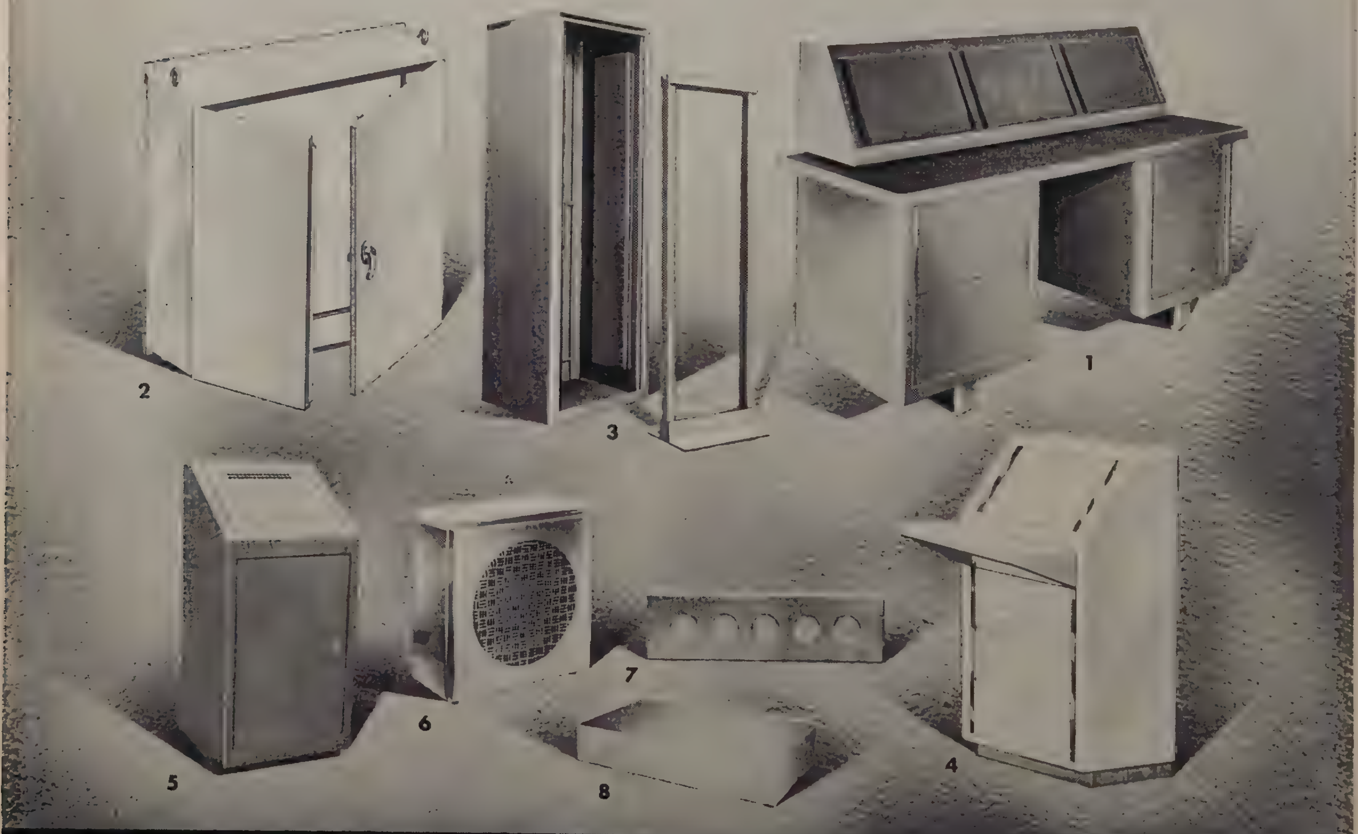

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Hammond's modern plant is equipped to produce durable, finely finished metalwork to close tolerances and high quality standards for Canadian Industry. The factory carries an extensive range of stock items, and dies used for more than 14,000 original metal fabrications are available to produce special requirements at an economical price.

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Battery charger

Self-contained, completely static battery charger for electric utility, railway communication and signalling, and industrial applications has been announced by the Rectifier-Capacitor Division, Fansteel Metallurgical Corp.

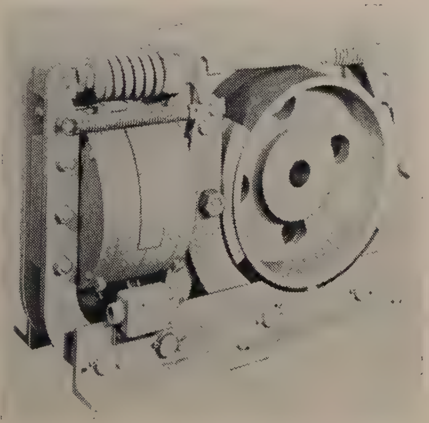
It employs a transistor, magnetic amplifier circuit and silicon rectifiers. The unit maintains its output voltage from no load to full load with 1% of the adjusted nominal voltage with 10% changes in line voltage.

The charger is suitable for lead-acid and nickel-cadmium batteries. Available in standard models with charging rates up to 100 amperes. Special units available on request. Input is 115/230 volts a-c-. Efficiency ranges from 75 to 80 percent.

In normal operation, with the battery floated across the output, the chargers delivers regulated d-c power to relays, pilot lights, tripping coils or carrier equipment. The charger also maintains the battery at full charge for emergency use. During overload or high demand, the battery supplements the charger while a current-limiting circuit protects the charger.

Use post-paid card, check item 25

Magnetic brake



The type TM Twin-Magnet direct current brake is the latest addition to the Canadian Westinghouse line of d-c magnetic brakes.

In addition to twin magnets, the brake features epoxy-encapsulated coils, has only two adjustments and no linkages below the brake proper.

Magnets (solenoids) can be removed without releasing brake shoes, thus any load suspended can be held in case of coil burnt-out. Overall dimensions are said to be the smallest of any A.I.S.E. brake on the Canadian market.

Use post paid card, check item 26

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demand
special design

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Where vital electrical circuits must continue to operate under extreme conditions of heat, Pirelli cables are available especially designed for the purpose.

Typical of the specialized high-temperature cables are the silicone rubber cables perfected by Pirelli's research laboratories for the Canadian Navy's new destroyers. The exacting specifications for these cables require that they continue to operate even after being temporarily subjected to fire.

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Spaulding FIBRE FACTS FOR ENGINEERS NUMBER 5

How to Achieve Permanence at Low Cost

by K. H. Alverson, Product Standards Director

Seldom is a high degree of permanence found associated with the characteristics of dielectric strength, rugged structural strength and arc resistance at such low cost as in Vulcanized Fibre. This permanence and strength allows the engineer to use Vulcanized Fibre to replace more expensive plated or coated parts even where insulating or arc resisting properties are not required.

The reason for Vulcanized Fibre's agelessness lies in the chemical action of its production which arrests the natural tendency of cellulose to deteriorate. This renders Vulcanized Fibre more stable than the hardest wood. (Corrosion, such as attacks metals, is completely precluded since Vulcanized Fibre has a non-mineral base.)

The permanence of Vulcanized Fibre in use is well illustrated by its application as insulation in transformers, switchgear, and circuit breakers. Parts such as corrugated duct spacers, arc chutes and barriers are subjected to terrific arc exposure and must maintain their form, strength and electrical properties for years under continuous operation in hot oil. Lightning arresters and high voltage fuses, made from Fibre tubing for protecting power line transformers, are still in service and operation, in satisfactory condition, after more than twenty years of use.

Industrial fuses with a fibre case and replaceable fuse link are one of the best known uses for Fibre tubing. If the fuse blows, the link is simply replaced and the fuse case used over and over again.

Fibre grommets are used to form a permanent locked-in-place insulator in metal assemblies, such as clocks, motors, etc. They will not deteriorate and fall out as will rubber. Fibre grommets for such applications are approved by the Underwriters' Laboratories.

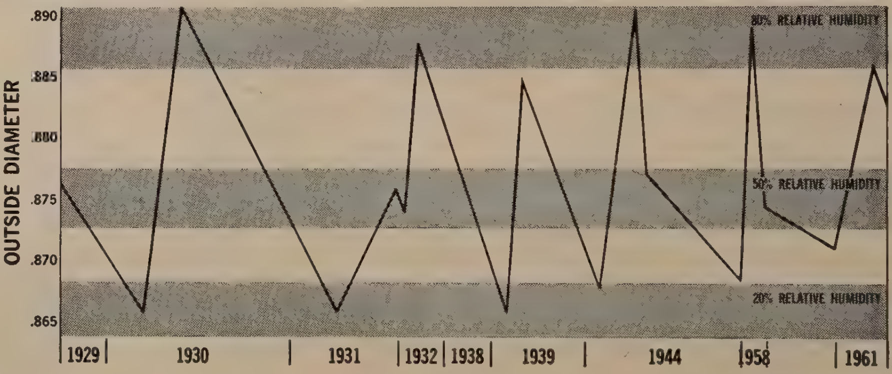
Fibre is non-corroding, unaffected by oils, greases, solvents, etc. It withstands the pounding of heavy trains when used as track insulation under outdoor exposure. Easily formed into complex shapes for use in athletic equipment, welding helmets, etc., all of which must withstand harsh usage without failure.

Trunk coverings, sample cases, factory trucks and waste baskets have been made for years of Vulcanized Fibre to take advantage of the light weight, abrasion resistance and permanence of the material.

Because of its many unique characteristics, Vulcanized Fibre offers a virtually endless variety of applications.

Spaulding Engineers who have been trained in Value Analysis can help you take advantage of the wide range of possibilities in designing to reduce costs through the use of Vulcanized Fibre parts. They also make available to you Spaulding's extensive fabricating facilities and experience in working with this extraordinary material.

While many materials deteriorate over the years, Vulcanized Fibre maintains its essential properties for decades. Note how the linen tag attached to Fibre tube samples in 1929 shows age, but Fibre tubes look and act as they did 32 years ago.



Long term test of fibre, which has been going on since 1929, shows that fibre still responds to wide humidity changes in the same way it did when test began. Predictable changes in dimension occur when fibre tubing is subjected to extremes of humidity. Tests such as these prove that there is no change in Vulcanized Fibre characteristics over long periods of time.

Be sure to add this FREE Literature to your reference files. *WRITE TODAY.*

New Value Analysis Brochure a detailed review of the Spaulding Value Analysis technique together with case histories of design improvement and cost reductions that have been accomplished through Spaulding's Value Analysis of customer products. 12 pages.

Vulcanized Fibre Engineering Data — a design reference book which comprehensively covers all the application specs of Vulcanized Fibre. 10 pages.

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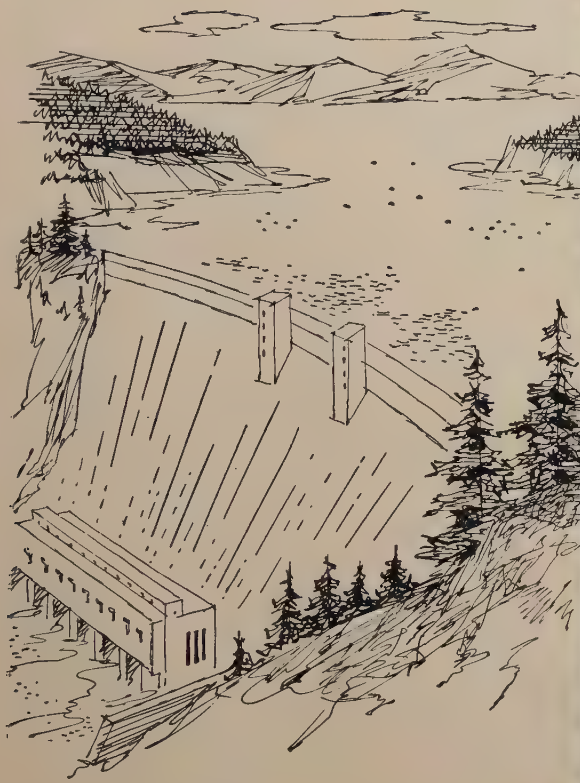
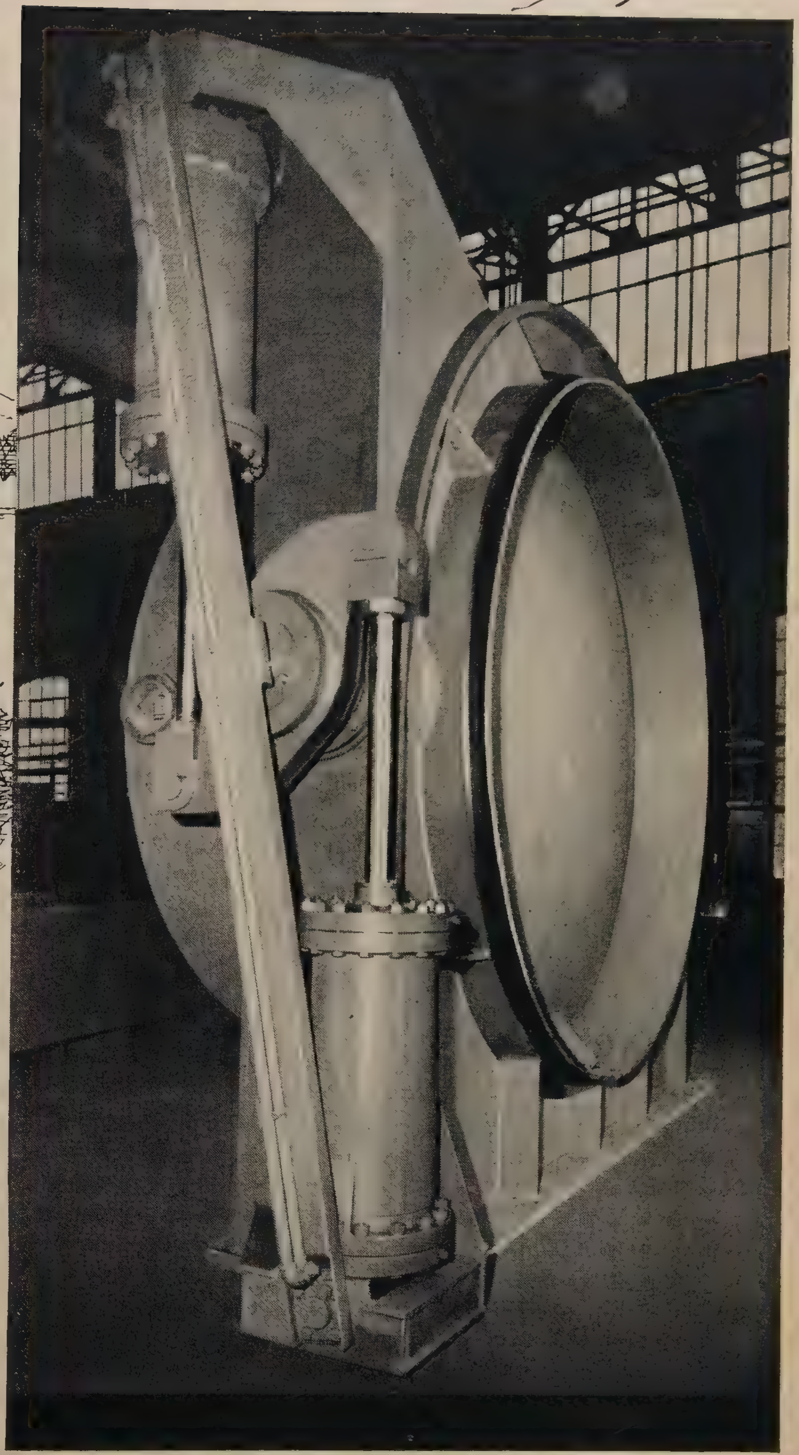
Butterfly Valves





Designed for 80 p.s.i. water pressure and emergency closing against flow of 1,680 C.F.S. under 123 ft. head, the illustration shows a shop photo of one of three 12′-0″ Turbine Shut-off Butterfly Valves built for a progressive mining Company in Quebec.

The valve body and disc are entirely fabricated from Steel Plate with the seal seat and disc seal of Stainless Steel. The seal of the disc is adjustable.

Another example of the fine engineering Industry expects from the shops of Canadian Vickers.

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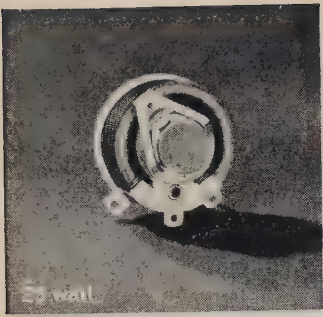

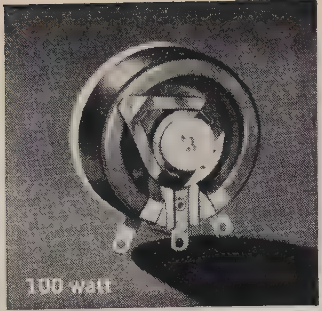

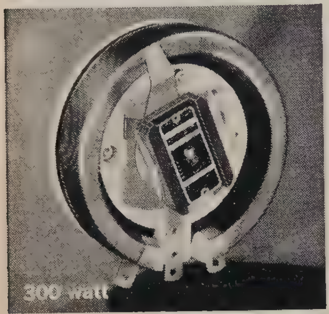

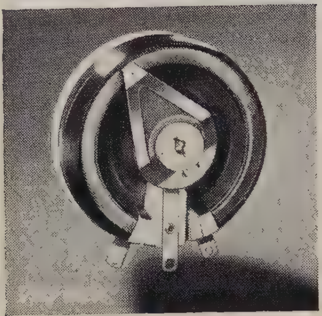

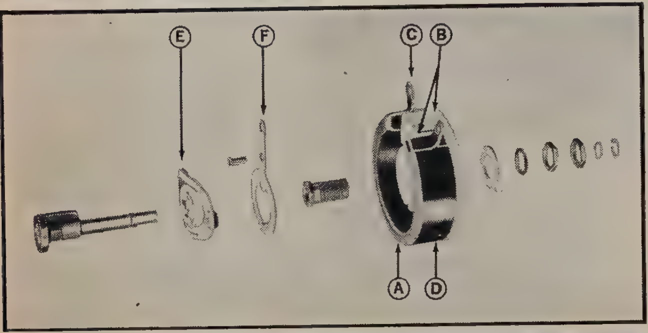

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From 25 to 300 watts these VITROHM ring rheostats are engineered for longest life, maximum reliability

To be sure about smooth, trouble-free control in the 25- to 300-watt range—just specify a VITROHM rheostat.

You get smooth control: Close-laid turns (A) of special wire or ribbon insure smooth gradual resistance change from zero to maximum.

You get reliability: VITROHM rheostats are engineered for permanence from ceramic base and core (B) to durable terminals (C), to final long-lasting VITROHM bonding (D).

You get positive action: Self-lubricating twin-shoe contacts—exclusive with W/L—on balanced contact arm (E) eliminate backlash, minimize wear, assure positive contact to collector.

Check *all* the features in W/L Bulletin 6003R (and for ratings above 300 watts, check Bulletin 60A). Write Ward Leonard of Canada, Ltd., 1070 Birchmount Road, Toronto 16, Ont.

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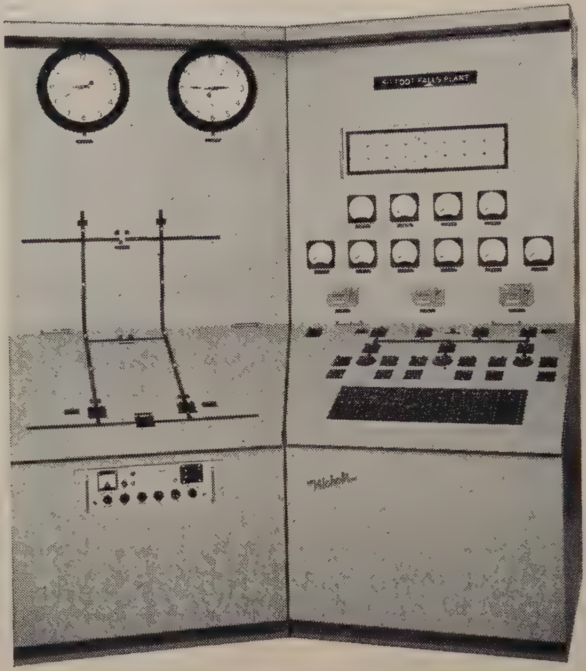

Quebec Cartier's 3-unit generating station at 50 Foot Falls is controlled from the Lac Jeannine site by a Nichols "SUPER-TROL" System.

Duplicate VHF radio channels in both directions with automatic transfer facilities . . . frequency shift audio tone signalling . . . complete control of generator functions . . . 24-point alarm annunciation . . . continuous and selective telemetering . . . transfer-trip protects two transmission lines . . . WWV receiver to correlate mechanical and electrical clocks for frequency control.

These and other facilities are incorporated in this custom built system, for complete and efficient remote control of 50 Foot Falls Generating Station.

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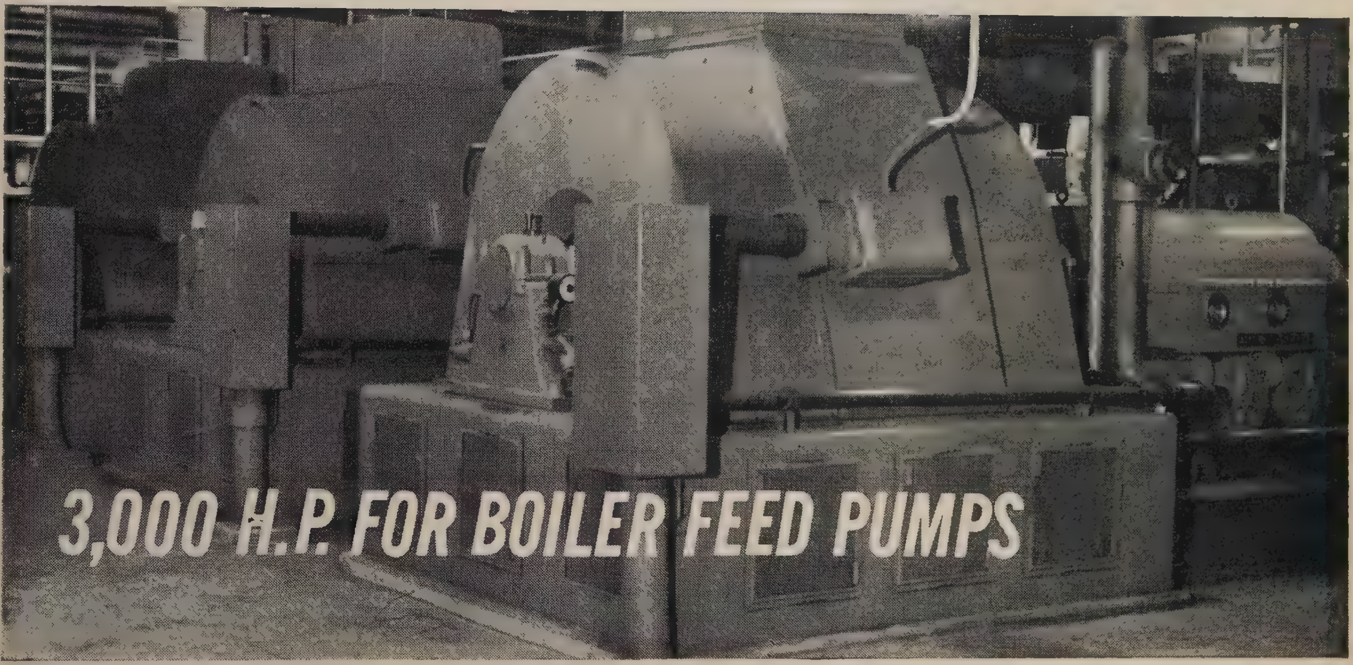

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The quality of A E I electric motors has been world famous for over fifty years, and a quarter of a million have already been supplied to Canada.

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BOOKS

Operational Electricity. By C. I. Hubert. Published by John Wiley & Sons. 530 pages. $8.50.

This book represents a break with tradition. After careful analysis of the traditional methods of teaching this subject and critical examination of the demands the subject places on teacher and student alike, the author concludes that an integrated study of ac and dc circuits and machines offers much more than the usual separate treatment. He recognizes the fact that fundamental laws apply equally to both systems, and that dc is only the special case of ac at a frequency of zero cycles per second.

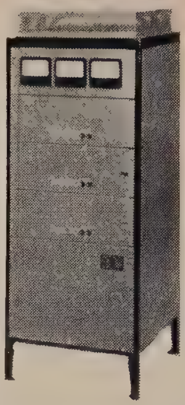
The text is operational in character. Wherever possible, the author has injected applicable operating techniques in addition to incisive treatments of the parallel operation of generators, the selection and application of motors and controls, magnetic controllers, and regulators.

Management Models and Industrial Applications of Linear Programming. By A. Charnes and W. W. Cooper. M.I.T. Press and Wiley. Volume I, 471 pages. $11.75.

All aspects of the underlying theory of linear programming are illustrated, and concrete numerical examples are accompanied by explanations which explain the theories and examples, and suggest further possible applications. Geometric representations are included. From the theoretical standpoint, a unified approach to a wide variety of mathematical theorems is supplied by the idea of "regularization". This is developed around the concept of linear programming itself.

Transistor Logic Circuits. By R. B. Hurley. 363 pages. Wiley. $10.00.

Covers logical mathematics, logical routines and blocks, as well as the transistor circuits that implement the mathematics and blocks. The author leads the reader from elementary binary arithmetic and Boolean algebra through minimization techniques and implementation concepts in the first part of the book. This material is followed by a basic treatment of diodes and transistors and a section combining the mathematics with the devices into logic circuits. A variety of application examples are employed to make the integration of the mathematics and devices into useful combinational circuits clear.



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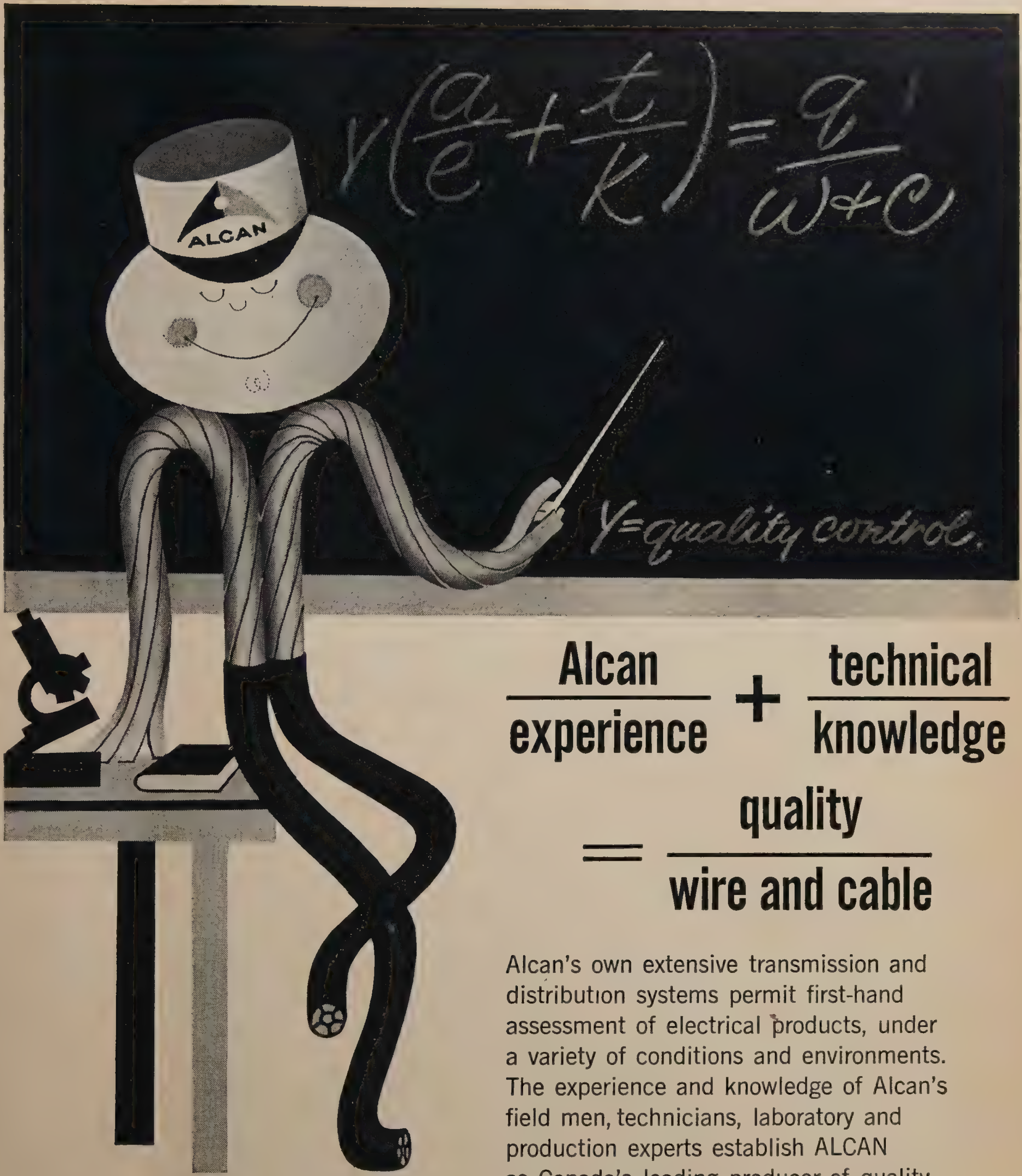
Error-Correcting Codes. By W. W. Peterson. 285 pages. Wiley. $7.75.

The first five chapters give an up-to-date treatment of coding theory and systems known before 1958; the last seven chapters discuss more recent developments in terms of both theory and implementation. Five appendixes provide supplementary information.

The book tells in detail how to implement codes in practical systems. Emphasis is on types of codes that have mathematical, especially algebraic structure. The mathematics necessary for understanding of coding theory is included in the book. The book is addressed to engineers who require a thorough knowledge of coding.

Sequential Decoding. By J. M. Wozencraft and B. Reiffen. 73 pages. Technology Press and Wiley. $3.75.

By presenting a procedure that reduces the growth of complexity with delay, this monograph points out that coding can become a practical design technique available to the communications systems engineer. This research will interest communications systems engineers, data processing engineers, and information theorists.



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BOOKS *(Continued)*

Water Power Development. Volume 2: High-Head Power Plants, Midget Stations, and Pumped-Storage Schemes. By Emil Mosonyi. Distributed by Pannonia Books, Toronto. 1140 pages. $23.00.

Dr. Mosonyi enjoys a world-wide reputation, and this second volume of a trilogy has been very favourably reviewed in the European technical press. It is well-nigh encyclopaedic in its range and detailed examination of numerous stations and schemes. Volume 1, which deals mainly with low-head plants, is still available.

Magnetic Control of Industrial Motors. Part I: A-C Control Devices and Assemblies. Part II: A-C Motor Controllers. By G. W. Heumann. Part I, 273 pages. Part II, 334 pages. Wiley. Each volume $9.00.

In what is primarily an application book, controllers for industrial motors are carefully analyzed. Motor performance data for squirrel-cage, wound-rotor, and synchronous motors are presented. This is accompanied by formulas useful for calculating motor performance when motors are used with different types of controllers. Topics include circuits, selection of controller sizes and components, economic factors affecting controller selection, motor protection, and existing safety codes and standards.

Part III of this work is entitled "D-C Motor Controllers".

Design of Small Direct-Current Motors. By A. F. Puchstein. 407 pages. Wiley. $12.00.

A compendium of methods for solving the problems involved in the calculation and design of direct-current machines. There is a wide variety of design problems and also detailed presentation of the methods. The author gives methods both for those cases in which mechanical parts are available and for those in which no mechanical parts are available and design must proceed "from the ground up". In every instance, presentation of a method includes precise instructions, alternate procedures, numerical examples, and exact results.

Many new design procedures are given. Problems calling attention to significant theoretical and practical points are included for the use of both the general reader and the student.

Cybernetics. Second Edition. By N. Wiener. 212 pages. Wiley and M.I.T. $6.50.

One of the most widely discussed books in recent scientific history. Cybernetics itself is a new science named by Dr. Wiener and his colleagues in the summer of 1947. It deals with the close study of human control functions and of the mechanico-electrical systems designed to replace them. Because of its nature, it touches on every branch of science in which control or communications has a part. Cybernetics has stemmed from wide theoretical study and experimentation by Dr. Wiener and a group of outstanding scientists — including physiologists, psychologists, mathematicians, and electrical engineers.

The book's subject matter ranges from such control mechanisms as mathematical calculators to the nerves and brain of the human body. The second edition has been completely re-edited and contains two new chapters and a new introduction by Dr. Wiener. Dr. Gordon Raisbeck of the Bell Telephone Laboratories is technical editor of this edition.

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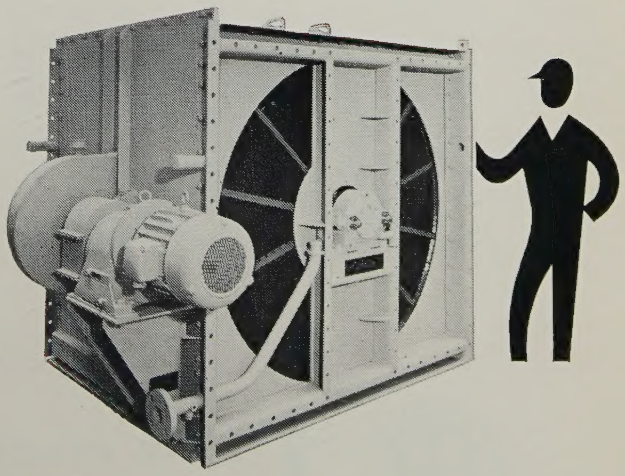

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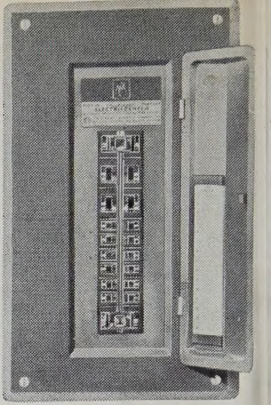

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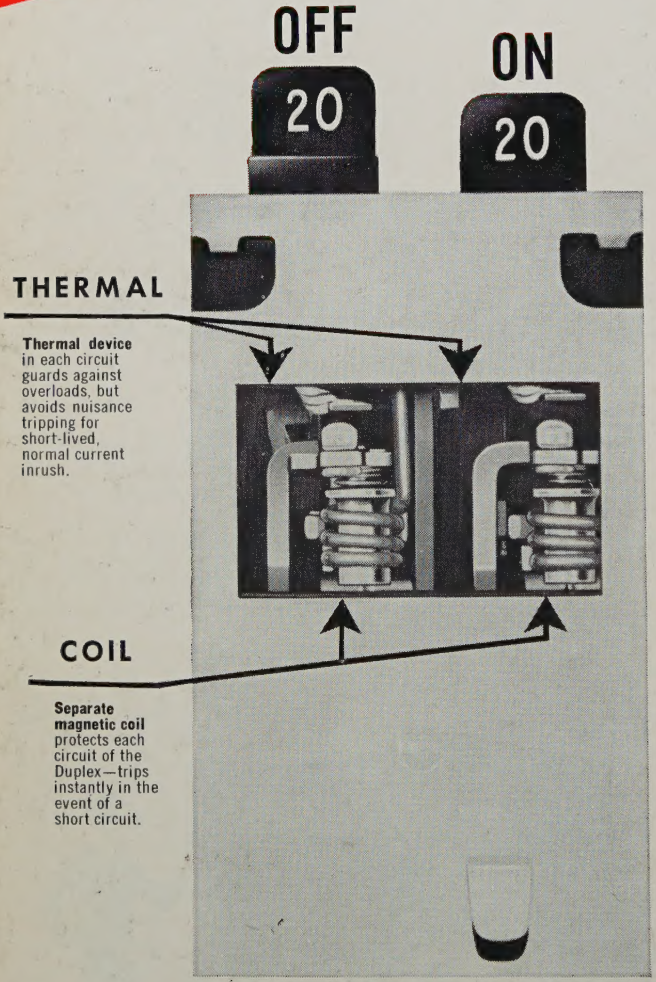

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